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In This Issue

Can We Curb the Irresponsibles?

Lawrence K. Frank

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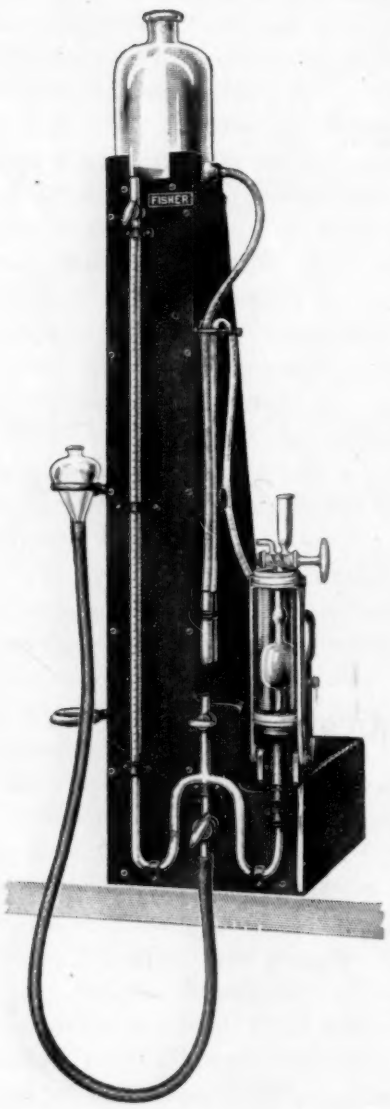

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SCIENCE

Vol. 103, No. 2673 Friday, March 22, 1946

Can We Curb the Irresponsibles?

Lawrence K. Frank, *Chairman*
Committee on Science and Society, AAAS

THE TRIAL OF THE WAR CRIMINALS in Germany is an event of major significance, going far beyond the punishment of those who ordered or committed atrocities. It marks the first formal step toward fixing responsibility upon military men for deliberately planning to make war and to conquer, subjugate, and destroy other nations. It has a direct bearing upon the scientists today.

This is indeed a step with far-reaching consequences, for it boldly approaches the basic problem of curbing the irresponsibles, especially those with the immense power and military authority for making war who can control armies, navies, and air force, and also the full resources, human and natural, of a nation. These are the individuals who wantonly and irresponsibly plot to invade their neighbors, devastate open cities, and unleash death and misery upon the world.

Heretofore the generals and admirals and their staffs, when and as they decided it was necessary or would be safe and advantageous to their country, planned and waged war. They were privileged and protected by the fiction that they were patriotically obeying the orders of their country, which they obediently served, even though it was evident that they had long planned the war and carefully provoked the incidents that started hostilities.

Now, thanks largely to the vision and courage of Justice Robert Jackson, the trial of war criminals moves forward to the unprecedented position of accusing the military and naval leaders of Germany of deliberately plotting war and planning for conquest. They are therefore being tried as war criminals by the International Court at Nürnberg while the lesser command are being tried elsewhere for atrocities and almost unbelievable cruelties inflicted upon helpless, unarmed people and apparently ordered by the higher command.

The Principle of Responsibility

This trial and the fully documented accusations are based upon the principle, now clearly enunciated and applied for the first time, that the exercise of irresponsible military and naval power is a criminal offense *against world order*—not international law.[1] Any defense they may offer of obeying orders like good, patriotic soldiers, will be stopped by this principle of personal responsibility for exercise of the supreme power they enjoyed and of accountability for using that power to break the peace and disrupt world order deliberately.

It is worth recalling that in earlier centuries, before the rise of the national state, the smaller units of territory in Europe were held by feudal lords who were at once the rulers and also the military leaders of their lands. A lord organized, directed, and led his men at arms, either in defending his land or in attacking others' land. They were involved in an intricate web of feudal relationships in which they were often called upon to help another lord or were themselves aided by another. If defeated, they might call for assistance from their feudal allies or enter into a new alliance with someone who could protect them. But often defeat meant paying the penalty, personally, of losing their land, their stronghold, and even their life. Responsibility and accountability were real, immediate, and inescapable since they had no convenient excuse for obeying orders or being patriotic.

When, however, the professional soldier and sailor began to appear with the rise of the national state, they emerged from this older tradition, retaining the protocol of rights and privileges and honors, but becoming—to speak plainly—hired fighters, however dignified, honorific, and patriotic they claimed to be.

Professional soldiers and sailors at the top ranks thus evolved into a specialized caste, proud and often arrogant in their rank, prestige, and power. Academies arose to train these specialized men, to indoctrinate them with the traditions and protocol, as we

[1] The plea, strongly urged by some in this country, that this is *ex post facto* law, an attempt to convict individuals as criminals for acts which heretofore were not so declared, must also be denied. The prohibition of *ex post facto* laws is a highly desirable, indeed essential, protection of civil liberties in an individual country, but in international affairs it does not have the same claim to validity. Aggressive acts by one nation against others cannot be construed as a right or power to be enjoyed until formally declared illegal. Nor can the individuals who made the plans and decisions for aggressive warfare take refuge in the law of agency, since they were principals before they became agents of war making.

see in our own Navy personnel, and to foster their professional careers. They often languished during the times of peace, but flourished during war, after each of which they accumulated more power and authority in the nation, as the history of Europe shows.

Planning for the next war, including full utilization of national resources, became the accepted national practice, with a general staff continuously engaged in making strategic plans and conducting maneuvers, designing and testing new weapons, and preparing their forces for action. These professionals, *win or lose,* enjoyed their rank and privileges and their irresponsibility. In every large country today, professional military and naval men now exercise these enormous powers with weapons of unprecedented power of destruction, now enlarged by the atomic bomb. They are no longer just *agents* of the national government: they are now the principals who can and do determine policies and make the decisions that commit the whole nation to aggressive warfare and conquest. To permit these individuals to continue their irresponsible careers of deliberately planning, and thereby often provoking, war has become intolerable.

It is clear that the United Nations Organization, made up of representatives of the several national states, will be at the mercy of these irresponsible military men especially in those countries where they can, and do, dictate national policies and international relations. If this attempt to establish some form of world-wide organization for maintaining peace is to function more effectively than the League of Nations, these irresponsible and often ruthless military leaders must be made accountable and brought under some effective world control.

The Nürnberg trial, therefore, is the first attempt to curb these irresponsible individuals in the interest of establishing world order and limiting militarism, with its conscription of man and woman power and mobilization of all national income and resources for total war.

The military and naval men outside of Germany are not happy over this trial since it strikes at their traditional privileges and threatens to deprive them of their irresponsible power by denying them the protection of the time-honored pleas of obeying orders and being patriotic.

Yet this doctrine of responsibility cannot be limited to the army and navy high command. It is clear that in Germany the owners and managers of large heavy industry and of technical works worked closely with the General Staff to plot and prepare for war and to wage war. Likewise, the financial groups were equally involved in this plotting and did their full share to expedite the all-out war effort and the looting of conquered countries.

Once this principle is established there is no valid reason for not extending it to all the warmongers, the writers and publicists, legislators, and indeed all those who publicly demand war against any nation they dislike or wish to despoil, or who surreptitiously foment war.

Scientists and the Principle of Responsibility

Thus, we must ask about extending this principle to the scientists, since it is clear that through research and experimental applications (such as bombs and rockets and radar) they are now the key group in planning and preparing for war. The atomic bomb has made this plainly evident and thereby has clarified the basic issue of responsibility as nothing else has done. The scientists themselves have been shocked into an awareness of their new role and their world-wide responsibilities. Never before have scientists, as a specialized group, been deliberately organized to wage war as they have done during World War II and, now, to prepare for the next war as provided in the National Defense Research Board, set up by the National Academy of Sciences, with the collaboration of the Army and Navy. *If the scientists are to succeed the generals and admirals and take over some or all of the functions of the General Staff, are they to enjoy the irresponsibility of the professional soldier and claim the traditional protection of being obedient, patriotic agent-citizens serving their country?*

This is the crucial question now being discussed by scientists, especially in the United States. Many of the atomic or nuclear physicists, especially the younger men, have become fully aware of this issue and apparently are prepared to take action as a responsible, accountable group. Others are calling for a new world government, apparently as a plea in avoidance, because they will not, or cannot, accept the immense responsibility that goes with the great power of their new knowledge and techniques.

Recently the proposal has been made (*Science,* 1945, **102,** 672) that the scientists themselves come together from all lands to form a world association of physicists who will agree among themselves, as scientists, with a full awareness of their unique position, to keep the peace by refusing to lend their knowledge to the making of atomic bombs. (Also see, *Science,* 1946, **103,** 158–160.)

If the scientists who, by profession and tradition, are dedicated to disinterested, impersonal research, and who have long accepted the internationality of science, will accept this professional responsibility, then we can begin to arraign all the others who are

irresponsible in their several fields—the political leaders and legislators, newspaper owners and columnists, and commentators; the international manipulators of economic affairs, the cartelists; indeed, all those who are now privileged, as individuals and in groups, to provoke and to contrive war and otherwise to disturb peace.

No nation, as Edmund Burke told us, can be indicted, but we can and must fix responsibility upon the individuals who, in positions of power and authority—military, naval, economic, and financial (and now scientific)—are the active principals and directors of the national, monolithic, aggressive state. If there is to be atomic warfare, it will come by the plans and decisions of specific individuals who have deliberately calculated their preparation and use upon specific targets. If we will accept the principle of accountability, these can be identified and legally tried and convicted for their individual and joint acts, just as the leaders of a mob can be tried and convicted for arousing and directing mob action. A firm declaration of this policy and application of this rule may offer what the many paper schemes of control and inspection are vainly seeking to achieve for controlling atomic bombs.

Curbing these irresponsibles is not a revolutionary act. It is the continuation of our legal traditions which, over the centuries, have recognized the principle of accountability for actions injurious to others. Just as in the early days of Anglo-Saxon jurisprudence the principle of individual accountability had to be wrought out and then painfully established, to replace the ancient doctrine of group responsibility, so today we face an equally momentous step, of fixing responsibility upon individuals for the disturbance of peace and world order. Today we can now assert and prove that these specific individuals, *with intent,* plotted and planned the war in which they used their nation and its sovereignty for deliberate aggression.

If we can make this clear, perhaps we can enlist the men and women of good will the world over in supporting this first concrete action for establishing the responsible conduct necessary for world order, the indispensable condition for the effective operation of the United Nations Organization or any world state.

Justice Robert H. Jackson's opening statement for the United States, the complete text of the indictment, and the text of the four-power agreement on which the Nürnberg trials are based will be found in Robert H. Jackson, *The case against the Nazi war criminals,* Alfred A. Knopf, N. Y. 1946.

"I Got Previous Experience With This Stuff"

From *The Washington Post* 13 March 1946

Technical Papers

Hemolytic Streptococcal Sore Throat: Antibody Response Following Treatment With Penicillin, Sulfadiazine, and Salicylates[1]

LOWELL A. RANTZ, *Stanford University Hospital, San Francisco*; PAUL J. BOISVERT, *New Haven Hospital*; and WESLEY W. SPINK, *University Hospital, Minneapolis*

Information has recently been obtained during a field study with regard to the formation of antistreptolysin and antifibrinolysin following acute Group A hemolytic streptococcal sore throat in military personnel. A complete description of the relationship of these and other streptococcal antibodies to the observed clinical phenomena will be presented elsewhere. Many of the infected individuals were treated by the administration of penicillin, sulfadiazine, or salicylates. Because of the great interest in chemo- and antibiotic therapy, it seemed desirable to present immediately the results of this study in so far as it bears on antibody response in treated and untreated cases.

Sera were obtained on approximately the third and twenty-first days from 351 cases of acute Group A hemolytic streptococcal sore throat. The diagnosis was made on clinical and bacteriological grounds. The exact criteria and techniques will be described elsewhere. The antistreptolysin titers were determined by a modification of the usual technique (*5*). Antifibrinolysin titers were also measured at similar intervals in 321 cases (*1*).

Two hundred and thirty-three cases received no treatment except hot saline gargles. Chemo- or antibiotic therapy was begun in the others on the second or third day of the acute illness and continued according to the following schedules:

Salicylates: 10 grams of sodium salicylate were administered by mouth each day for approximately one week.

Sulfadiazine: 4 grams of sulfadiazine were administered by mouth as an initial dose, followed by 1 gram every four hours, day and night. The average total dose for the group was 39 grams and the duration of therapy 6.5 days.

Penicillin followed by sulfadiazine: 200,000 units of penicillin were administered intramuscularly in 18 to 24 hours, the individual injections being given at intervals of four hours. A standard oral course of sulfadiazine was begun with the last dose of penicillin, an average of 33 grams being given in 5.8 days.

Penicillin—short course: 200,000 to 400,000 units of penicillin were administered intramuscularly, at four-hour intervals in from 32 to 64 hours.

Penicillin—long course: 500,000 or 1,000,000 units of penicillin were administered intramuscularly at four-hour intervals in 80 hours.

Hemolytic streptococci usually disappeared from the throat during the exhibition of penicillin but frequently returned when the agent was withdrawn. At this time a clinical relapse often was observed.

The results of this study are included in Table 1. A 50-per cent increase in the antistreptolysin titer or a prolongation of clot lysis of more than eight hours were regarded as measures of significant antibody response.

TABLE 1

ANTISTREPTOLYSIN AND ANTIFIBRINOLYSIN RESPONSE IN ACUTE GROUP A HEMOLYTIC STREPTOCOCCAL SORE THROAT TREATED WITH VARIOUS CHEMICALS

Treatment	No. of cases	No. with bacteriological relapse	No. with clinical relapse	Antistreptolysin				Antifibrinolysin		
				No. of cases	Cases with antibody response	Per cent with antibody response	Mean increase titer units	No. of cases	Cases with antibody response	Per cent with antibody response
Salicylates	25	..	..	25	22	88.0	477	25	10	40.0
Sulfadiazine	36	..	..	36	30	83.3	327	31	15	48.5
Penicillin and sulfadiazine	25	20	9	25	22	88.0	263	25	8	32.0
Penicillin—short course	16	16	8	16	14	87.5	442	16	7	43.5
Penicillin—long course Bacteriological relapse	7	7	4	7	7	100.0	241	7	1	14.0
Penicillin—long course No bacteriological relapse	9	0	0	9	4	44.5	182	9	1	11.1
None	233	..	..	233	190	81.6	204	208	73	35.1

[1] This investigation was carried out during a field study by the Commission on Hemolytic Streptococcal Infections, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, Preventive Medicine Service, Office of the Surgeon General, U. S. Army. The laboratories of the Department of Medicine, Stanford University School of Medicine, San Francisco, were made available to the Commission for certain studies.

None of the therapeutic procedures prevented the formation of antistreptolysin or antifibrinolysin. The administration of salicylates, sulfadiazine, and/or a short course of penicillin failed to diminish the percentage of individuals exhibiting an antibody response, or the mean increase in antistreptolysin. The latter was greater in certain treated groups than in the controls. This result is probably not significant for the reasons stated below.

When penicillin was administered over a longer interval, the frequency of the antifibrinolysin response was decreased. An antistreptolysin response was also observed less often in those individuals in whom bacteriological relapse did not occur.

These latter observations suggest that the exhibition of penicillin in amounts adequate for the elimination of the hemolytic streptococcus from the throat may interfere with the formation of these antibodies. It is necessary to be very guarded in reaching such a conclusion based upon the study of small groups f individuals infected by a variety of types of Group A streptococci, since it has been demonstrated that the different types vary in their ability to stimulate the production of antistreptolysin (*4*) and antifibrinolysin (*2, 4*), and that great individual differences exist between various human beings in their ability to react to the antigenic stimulus of infection by these organisms (*3*).

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Blood Levels of Penicillin After Oral Administration With Various Antacids

Lloyd D. Seager

Department of Pharmacology, Woman's Medical College of Pennsylvania

Many antacids have been employed with apparent success (*2, 3, 5, 6, 7, 12*) in an attempt to protect penicillin from destruction when given orally. Considerable discrepancy appears in the results reported, and it was felt that a comparison of the effectiveness of various antacids in a group of normal adults would be desirable. Though there may be considerable variation in gastric acidity from time to time in the same individual, comparative studies made largely on the same group of individuals, under stated conditions, should be more valid than those made on different groups with a variety of illnesses.

Methods

Subjects were allowed to have a soft diet, low in protein and fat. They were given 100,000 units of calcium penicillin along with the equivalent of 2.5 grams of one of the antacids. Aluminum hydroxide, magnesium trisilicate, and magnesium hydroxide were given as magmas or gels. The penicillin was freshly mixed with these preparations before use according to the method of Welch (*12*). Trisodium citrate and aluminum dihydroxy amino acetate were used in tablet form with penicillin incorporated in them. Seven control tests were made with penicillin administered in tap water, and in one case it was given in tap water to a pernicious anemia patient. Blood samples were obtained at hourly intervals for 4 hours, and urines were collected up to 6–12 hours. Blood levels of penicillin were determined by the Fleming Slide cell method (*4*) and urine concentrations by the Oxford cup method (*1*).

TABLE 1

Blood Levels of Penicillin After the Oral Administration of 100,000 Units of Calcium Penicillin in Tap Water

Subject	½ hr.	1 hr.	1½ hrs.	2 hrs.	3 hrs.	4 hrs.	Per cent excretion
*S	...	0.06	0.03	0	0	...	6.6
*S	...	.12	...	.03	0	...	....
*W	.12	.12	...	.06	0	...	15.9
†S	0	0	0	0	...	...	1.9
†W	...	0	0	0	0	...	1.5
†S	...	.12	0	0	0	...	1.25
†W	.03	0	0	0	0	...	0.48
‡R	...	0.24	...	...	0.24	0.03	24.2

* Empty stomach.
† Full stomach.
‡ Pernicious anemia.

TABLE 2

Blood Levels of Penicillin After Oral Administration With 100,000 Units of Calcium Penicillin in Aluminum Hydroxide Gel

Subject	1 hr.	2 hrs.	3 hrs.	4 hrs.
K	0	0.06	0.015	0.015
L	0.03	0.015	0.015	0
R	0.12	0.06	....	0
F	0.12	0.03	0.03	0
W	0.24	0.12	0.015	....
G	0.03	0.03	0.03	0.03
ST	0.24	0.24	0.06	0
Average	0.11	0.079	0.03	0.007

Results

Of the tap water controls (Table 1) these tests were made with 100,000 units on an empty stomach, and

four tests were made on the same subject after a full meal. Penicillin levels were present up to one and a half to two hours when given on an empty stomach, but in only one instance was the drug demonstrable in the blood at the end of one hour when given on a full stomach. Penicillin was demonstrable in the urine as early as three minutes after administration. When given on an empty stomach the excretion varied from 6.6 to 15.9 per cent. When given on a full stomach the excretion varied from 0.48 per cent to 1.9 per cent. A pernicious anemia patient given 100,000 units orally in tap water showed a blood level of 0.24 units/cc. up to three hours and a level of 0.03 at four hours. Excretion in the urine was 24.2 per cent.

TABLE 3

BLOOD LEVELS OF PENICILLIN AFTER ORAL ADMINISTRATION OF 100,000 UNITS OF CALCIUM PENICILLIN WITH MAGNESIUM TRISILICATE

Subject	1 hr.	2 hrs.	3 hrs.	4 hrs.
G	0.03	0.06	0.015	0
W	0.12	0.03	0.015	0
S	0.24	0.06	0.06	0.03
ST	0.24	0.03	0.03	0.03
C	0.24	0.03	0	0
Average	0.175	0.042	0.024	0.012

TABLE 4

BLOOD LEVELS OF PENICILLIN AFTER ORAL ADMINISTRATION OF 100,000 UNITS OF CALCIUM PENICILLIN WITH TRISODIUM CITRATE

Subject	1 hr.	2 hrs.	3 hrs.	4 hrs.
F	0.12	0.12	0.06	....
R	0.48	0.24	0.06	0
ST	0.12	0.06	0.015	0.015
C	0.12	0.12	0.015	0.015
F	0.12	0.06	0.015	0.03
S	0.06	0.06	0.015	0.015
Average	0.17	0.11	0.03	0.018

Blood and urine samples were taken hourly for seven hours. Urine collections continued at intervals up to 24 hours. No penicillin was demonstrated in the blood at any time by our method, and only traces appeared in the urine after nine hours. One subject given an initial dose of 50,000 units of this preparation followed by 25,000 units every hour for four hours showed hourly blood levels of 0.06, 0.12, 0.24, 0.12, 0.12, and 0.03. The excretion was 10.3 per cent.

TABLE 5

BLOOD LEVELS AFTER THE ORAL ADMINISTRATION OF 100,000 UNITS OF CALCIUM PENICILLIN WITH ALUMINUM DIHYDROXY AMINO ACETATE

Subject	1 hr.	2 hrs.	3 hrs.	4 hrs.
W	0.06	0.03	0.03	0
S	0	0.12	0.06	0.03
H	0.24	0.12	0.06	0.03
J	0.24	0.24	0.03	0
B	0.12	0.24	0.03	0
S	0.06	0.03	0.03	0
A	0.12	0.24	0.06	0.06
Average	0.12	0.14	0.043	0.017

TABLE 6

BLOOD LEVELS OF PENICILLIN FOLLOWING THE ADMINISTRATION OF 100,000 UNITS OF CALCIUM PENICILLIN WITH MILK OF MAGNESIA

Subject	1 hr.	2 hrs.	3 hrs.	4 hrs.
ST	0.06	0.03	0	0
S	0.24	0.24	0.12	0
ST	0.03	0.015	0	0
K	0.24	0.03	0	0

Blood levels for the five antacids studied are shown in Tables 2, 3, 4, 5, and 6. It is obvious that all the antacids gave striking increases in blood levels of penicillin as compared to the tap water controls. The highest average levels at the end of the first hour were with trisodium citrate and magnesium trisilicate. The highest average levels at the end of the second and third hours were with aluminum dihydroxy amino acetate. The highest levels at the end of four hours were with trisodium citrate and aluminum dihydroxy amino acetate. This may be correlated with the fact that these two preparations were given in tablet form. The lowest results were obtained with milk of magnesia. The differences with the other antacids employed were not striking.

In two experiments calcium penicillin was adsorbed on aluminum hydroxide according to the method reported by Welch (*12*) and was given on an empty stomach in doses of 25,000 units every two hours for four doses.

DISCUSSION AND SUMMARY

The five antacids used orally with penicillin in this study showed marked effects in maintaining the blood levels of the drug. With the exception of milk of magnesia, there were no striking differences with the various antacids. In no instance were the blood levels maintained as well as in the pernicious anemia patient who received the drug in tap water alone. Results with antacids are similar to the results obtained with the administration of penicillin in enteric coated capsules (*10, 11*), but the levels are far inferior to those obtained by the intravenous drip (*8*) or intramuscular administration in oil (*9*). It is apparent that maximum efficiency for the oral administration has not been attained.

Confirmation is lacking in my results of the prolonged blood levels of penicillin, as reported by Welch (*12*) when given in single or in divided doses with aluminum hydroxide gel.

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udies on the Toxicity of Streptomycin or Man: A Preliminary Report[1]

ROBERT A. HETTIG and JOHN D. ADCOCK

University of Michigan, Ann Arbor

The advent of a new therapeutic agent, such as reptomycin (*4*), inevitably arouses curiosity about its fficacy on the one hand and about its potential and ctual toxicity on the other. The parenteral adminisation of streptomycin to susceptible laboratory anials has produced fatty metamorphoses in the parenhymal cells of the liver and to a lesser extent in the ubular epithelium of the kidneys. These histological hanges, which have been demonstrated by Mushett (*3*) are reversible and disappear rapidly after the drug s discontinued. Since both crude and crystalline strepomycin preparations produce these changes readily, heir appearance must be attributed to a toxic property intrinsic in the antibiotic itself. Because of the esions demonstrated in the viscera of experimental animals, the authors have attempted to evaluate the effect of parenteral streptomycin on the renal, hepatic, and hematologic functions of man. In the course of these experiments some clinical reactions have been encountered and will be discussed below.

Nine patients, whose ages ranged from 15 to 61 years, served as subjects. The total dosages of streptomycin varied from 1,850,000 units administered over a period of 48 hours to 72,250,000 units given over a period of 56 days. Six of the nine patients received the antibiotic by intermittent intramuscular injections at 3- or 4-hour intervals. Two patients were given the drug by continuous intravenous infusion and one patient by continuous hypodermoclysis. One patient also received 40,000,000 units of streptomycin orally over a period of 11 days in addition to that administered parenterally. The following tests were performed just prior to beginning streptomycin and were repeated within 96 hours following termination of the administration: urea clearance, bromsulfalein, retention, cephalin cholesterol flocculation, and complete blood counts, including differential leucocyte counts. In addition, urinalyses were done at frequent intervals before, during, and following the experimental trial.

The results of these laboratory tests have been compiled in Table 1 together with the doses of streptomycin and the duration of administration. No impairment of hepatic or renal function was detected by the serial bromsulfalein, cephalin cholesterol flocculation, and urea clearance studies. The urines of two subjects (J.P. and I.S.) exhibited abnormalities of the formed elements during the experimental period. On the eighth day of streptomycin administration J.P. developed a microscopic hematuria which subsided a few days after the drug was discontinued. I.S. became intolerant of the antibiotic on the eleventh day of administration, as manifested by fever and arthralgia. At this time a slight albuminuria was noted, and the urinary sediment contained numerous hyaline and finely granular casts. These abnormalities persisted for 72 hours after the drug was discontinued and were no longer apparent when the formal post-streptomycin evaluation was conducted 96 hours after the conclusion of the experimental trial.

Since no significant decrease of the hemoglobin or erythrocyte levels was encountered in any case, it would appear that in these experiments streptomycin exerted no suppressive effect on erythropoiesis and produced no hemolytic reaction. The total and differential leucocyte counts of eight subjects exhibited no unexpected abnormalities. In the case of C.F., however, a leucopenia of 3,550 cells per cubic millimeter and a neutropenia of 48 per cent were detected at the termination of a 45-day trial. This depression of leucocytes persisted for only a few days, after which the white cell values returned to normal range.

Two additional patients, both desperately ill of tuberculous meningitis, received parenteral streptomycin. Since their precarious condition did not permit formal toxicity studies, the clinical data of these patients are not included in Table 1. One of these patients died after 7,000,000 units of the drug had been administered by continuous hypodermoclysis over a period of 3 days and the second patient expired after receiving 15,000,000 units by similar route over a period of approximately 4 days. Post-mortem histological examination of the liver and kidneys revealed no lesions which could be attributed to the action of streptomycin.

Although no evidence of serious organ toxicity has been demonstrated, undesirable reactions have occurred with the relatively crude preparations of strep-

[1] These studies were aided by grants from the executive board and board of governors of the Horace H. Rackham School for Graduate Study of the University of Michigan. The streptomycin used in these studies was furnished by Merck and Company, Inc., Rahway, New Jersey. The material was supplied as a dry powder of varying degrees of purity, the active principle being present as the hydrochloride.

TABLE 1

RESULTS OF STUDIES ON RENAL, HEPATIC, AND HEMATOPOIETIC FUNCTION BEFORE AND FOLLOWING STREPTOMYCIN

Clinical data					Blood values			Renal studies				Liver function		Comments
Patient	Diagnosis	Units of streptomycin administered and route	Duration of administration	Relation of values to administration	Hgb. in grams/100 cc.	RBC in millions per cmm.	WBC per cmm.	Urine albumin	Urine sediment	Urea clearance 1st hr.	Urea clearance 2nd hr.	Cephalin cholesterol flocculation	Bromsulfalein (% retained)	
R.S.	Urinary tract infection	1,850,000 I.M.	2 days	Before	16.6	4.7	10,350	1 plus	Many WBC	140%	96%	Neg.	0	Arthralgia, fever
				After	17.2	4.9	10,200	Neg.	0 WBC	100%	128%	Neg.	0	
J.H.	Urinary tract infection	3,000,000 I.M.	3 days	Before	15.5	4.4	5,500	1 plus	Many WBC	117%	125%	Neg.	0	Skin eruption
				After	16.5	4.8	7,200	Trace	Occ. WBC	119%	94%	Neg.	0	
E.J.	Urinary tract infection	4,000,000 I.M.	4 days	Before	12.8	5.1	7,700	Neg.	Many WBC	77%	56%	Neg.	5	
				After	13.7	4.3	8,800	Trace	Many WBC	57%	80%	Neg.	5	
I.B.	Urinary tract infection	5,000,000 I.V.	4 days	Before	10.9	4.8	12,000	Trace	Many WBC	80%	69%	Neg.	5	Skin eruption Low-grade fever
				After	12.0	5.0	7,500	Neg.	Occ. WBC	100%	70%	Neg.	5	
I.S.	Carrier Salmonella	16,000,000 S.C. 40,000,000 P.O.	11 days	Before	14.0	4.7	5,100	Neg.	Occ. WBC	85%	87%	Neg.	0	Severe arthralgia Low-grade fever
				After	13.7	4.4	6,650	Neg.	Occ. WBC	91%	98%	1 plus	0	
C.J.	Urinary tract infection	18,000,000 I.M.	9 days	Before	15.4	5.0	6,050	Neg.	Many WBC	49%	77%	Neg.	5	Histamine-like reactions
				After	15.2	5.3	6,800	Trace	Occ. WBC	60%	78%	1 plus	5	
J.P.	Pemphigus	20,000,000 I.V.	8 days	Before	12.2	4.0	11,800	1 plus	Occ. WBC	109%	82%	3 plus	15	Chill and fever of 105.5°
				After	12.0	4.2	11,400	Trace	40 RBC	105%	77%	3 plus	0	
C.F.	Tuberculous adenitis	41,250,000 I.M.	45 days	Before	11.9	3.6	6,300	Neg.	Occ. WBC	125%	117%	2 plus	10	
				After	14.5	4.4	3,550	Neg.	Occ. WBC	98%	72%	3 plus	0	
V.S.	Pulmonary tuberculosis	72,250,000 I.M.	56 days	Before	13.3	4.4	14,150	Neg.	Neg.	83%	72%	1 plus	0	Mild arthralgia Histamine-like reaction
				After	15.4	5.3	6,800	Neg.	Neg.	143%	100%	Neg.	0	

I.V. = continuous intravenous infusion. I.M. = intramuscular injection. S.C. = continuous hypodermoclysis. P.O. = oral administration.

mycin employed in these studies. These reactions ried in frequency and severity with different lots of material and were encountered more frequently in earlier less refined lots than in the more recent parations. Such undesirable effects can, we be-ve, be attributed to impurities rather than to the tibiotic itself.

The reactions were of two main varieties. The first s characterized by facial flushing, headache, and fall blood pressure, and resembled the classical response histamine. It appeared promptly following intra-nous or intramuscular administration and lasted om 10 to 60 minutes. This histamine-like reaction as noted in three of the several lots which were tested, nd when these same lots of streptomycin were given experimental animals, Molitor (*2*) was able to dem-nstrate a similar effect.

The second type of reaction consisted of fever, in-ariably accompanied by myalgias and arthralgias articularly in the temporomandibular joints and sub-ccipital region. These symptoms appeared only fter streptomycin had been given for a period of ime, varying from 24 hours to several days. In this eries of observations no clinical evidence of eighth-erve toxicity was encountered. Hinshaw and Feld-man (*1*) recently reported such toxic reactions in 3 of 34 patients who received streptomycin for considerable periods of time.

Skin eruptions appeared in two subjects on the third day of the experimental period. The rash of subject I.B. resembled erythema nodosum and was undoubtedly due to streptomycin. The clinical significance of the maculopapular exanthem of subject J.H. could not be satisfactorily evaluated because he had received pentobarbital concomitantly.

Local reactions, consisting of pain and tenderness at the site of intramuscular or subcutaneous injections, were related to the amount of impurities retained in the preparations used, less difficulty being encountered with the more refined lots of the antibiotic. These local effects were never severe enough to interfere with continued drug administration and could be alleviated by the local application of heat.

Further experience will be required to define the possible toxic effects of prolonged therapy with streptomycin. It is planned to extend these studies when sufficient supplies of this antibiotic are available for clinical investigation.

Summary

In this limited experience, tests of renal and hepatic function together with blood studies before and after the parenteral administration of streptomycin revealed no evidence of serious toxicity. Reactions, consisting of fever, arthralgias, and skin rashes as well as histamine-like effects, are believed to be due to impurities retained in the preparations of streptomycin employed in these studies.

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Complement-fixing and Neutralizing Antibodies Against Japanese B Virus in the Sera of Okinawan Horses[1]

Lt. Horace L. Hodes, Lt. Cdr. Lewis Thomas, and Lt. John L. Peck (MC, USNR)

U. S. Naval Medical Research Unit No. 2
Guam, Marianas

Early in July 1945, an outbreak of encephalitis appeared among natives of Okinawa. The disease, which eventually affected a number of American service men on the island as well as natives, continued to occur during August and early September. We have recently reported (*2*) that Japanese B encephalitis virus was the cause of the outbreak. This conclusion was reached by the demonstration of the development of a significant titer of complement-fixing antibodies against this active agent in the sera of convalescent patients and by the isolation, from the brain of a patient dying of encephalitis, of an active agent which was identified by specific complement-fixation and neutralization reactions as Japanese B virus.

It is known that horses are susceptible to several kinds of encephalitis. In view of this fact, evidence was sought regarding the role that horses played in the outbreak of encephalitis in Okinawa. Accordingly, sera, collected in mid-August from nine Okinawan horses in areas where encephalitis was present among human beings, were tested for complement-fixing antibodies (*1*) against antigens prepared from the viruses of Japanese B, Western equine, and Eastern equine encephalitis. Sera of five Okinawan goats from the same areas and serum obtained on Guam from a normal horse were also tested. All sera obtained from the Okinawan horses fixed complement in the presence of Japanese B virus in a final dilution of 1:16 or greater (a 2+ reaction in a dilution of 1:8 or higher is significant). The serum of one horse yielded a titer of 1:128; two, a titer of 1:64; three,

[1] The Bureau of Medicine and Surgery of the U. S. Navy does not necessarily undertake to endorse the views expressed in this paper.

a titer of 1:32; and three, a titer of 1:16. All these sera failed to fix complement to a significant degree when tested against Western equine encephalitis virus; three of the sera also gave negative results with Eastern equine encephalitis virus. Sera of five Okinawan goats failed to fix complement in the presence of Japanese B or Western equine encephalitis virus; sera of two of these animals also gave negative results with Eastern equine encephalitis virus. Serum of the normal Guamanian horse contained no complement-fixing antibodies against any of the three virus antigens employed. The results of the complement-fixation tests indicate that all nine Okinawan horses tested had had some previous contact with Japanese B virus.

TABLE 1

NEUTRALIZATION TESTS WITH SERA OF OKINAWAN HORSES AND JAPANESE B VIRUS (NAKAYAMA STRAIN)

Serum	Titer of complement-fixing antibody	Sera used in neutralization test	Fate of mice following intracerebral inoculation of serum plus virus mixture: Dilution of virus in mixture 10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	Titer of virus in presence of serum*	Neutralization index†
Okinawan Horse No. 1	More than 1:128	Horse No. 1 and Horse No. 3 (Pool I)	4/4	4/4	0/4	0/4	0/4	0/4			$10^{3.5}$	30,000
Okinawan Horse No. 3	1:32											
Okinawan Horse No. 2	1:32	Horse No. 2 and Horse No. 19 (Pool II)	4/4	2/4	0/4	0/4	0/4	0/3			$10^{3.0}$	100,000
Okinawan Horse No. 19	1:32											
Immune rabbit vaccinated against Jap B virus	Not tested	Immune rabbit	...	1/3	0/4	0/4	0/4	0/3			$10^{2.8}$	150,000
Normal Gaum Horse No. 4	0	Horse No. 4	...	4/4	4/4	4/4	4/4	4/4	2/4	0/4	$10^{8.0}$	1

* Titer of virus is expressed as the highest dilution of virus giving a 50-per cent mortality.
† Neutralization index is the ratio between the titer of the virus in the presence of the serum under test and its titer in the presence of serum of the normal horse.
4/4—Four of four mice injected died.

Evidence that the Okinawan horses under study had been in contact with Japanese B virus was obtained also by neutralization tests. In this test, serum of Okinawan horse No. 1, which had a complement-fixing titer of 1:128 against Japanese B virus, was combined with serum of Okinawan horse No. 3, which exhibited a titer of 1:32 (horse serum Pool I, Table 1). Similarly, sera of Okinawan horses No. 2 and No. 19, each having a complement-fixing titer of 1:32, were combined to form horse serum Pool II. Portions of each pool of Okinawan horse sera were mixed with equal volume of decimal dilutions of Nakayama strain of Japanese B virus, and the mixtures were incubated for 2 hours at room temperature. Serum of a normal Guamanian horse, and that of a rabbit which had received a number of inoculations of Japanese B virus were tested in the same manner. After incubation, the serum-virus mixtures were inoculated intracerebrally into mice, four animals being employed for each serum-virus dilution mixture. Mice surviving 18 days were regarded as protected. The protection afforded by each serum was estimated by the method of Reed and Muench (*3*).

An examination of Table 1 reveals that the titers of the virus in the presence of the sera comprising Pool I and Pool II were, respectively, $10^{3.5}$ and $10^{3.0}$. On the other hand, the titer of the virus mixed with serum of the normal Guamanian horse was $10^{8.0}$. The neutralization index, which is the ratio between the titer of the virus in the presence of the serum under test and its titer with normal serum, was, therefore, 30,000 for the sera of Pool I and 100,000 for Pool II. This means that these pools of sera possessed, respectively, 30,000 and 100,000 times more neutralizing power than that shown by normal horse serum. In fact, their protective action approached that of the serum of the hyperimmunized rabbit, which exhibited a protective index of 150,000. Experience has shown that a neutralization index greater than 1,000 is significant. The results recorded in Table 1 indicate that at least one of the two Okinawan horses furnishing serum for each pool had developed a high titer of neutralizing antibodies against Japanese B encephalitis virus.

The evidence thus furnished by both complement-fixation and neutralization tests supports the conclusion that the horses studied had had contact with Japanese B encephalitis virus. The nature of this contact is not known, but the results described support the idea that horses may have been of epidemio-

ic importance in the outbreak of Japanese B encalitis which began on Okinawa during July 1945.

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The Absorption of Orally Administered Penicillin[1]

WALSH MCDERMOTT, PAUL A. BUNN, MARIA BENOIT, REBECKAH DUBOIS, and MILDRED E. REYNOLDS

Department of Medicine, Cornell University Medical College, and *The New York Hospital*
New York City

In a previous communication (*7*), it was reported that when penicillin was administered orally to fasting subjects the concentrations attained in the blood and the range of urinary excretion were of the same order of magnitude whether the penicillin was presumably protected against destruction in the stomach by the use of oil, oil-beeswax, or an antacid, or whether it was ingested as the aqueous solution. Regardless of vehicle, it was necessary to administer approximately five times as much penicillin by the oral as by the intramuscular route to obtain comparable concentrations of penicillin in the blood. In no instance was more than 32 per cent of the ingested penicillin excreted in the urine during the 12 hours immediately following ingestion.

This low urinary excretion after oral administration is in striking contrast to the 70 to 100 per cent urinary excretion which Martin and Kirby (*9*) have demonstrated after single parenteral doses. In experiments which will be published elsewhere (*8*), there was no evidence that penicillin is destroyed in the portal circulation. Moreover, penicillin is not destroyed by whole blood *in vitro* when incubated at 37° C. for a four-hour period. It appears, therefore, that the quantitative difference between the urinary excretion of penicillin after parenteral injection and that observed after oral administration represents the penicillin which is not absorbed. Presumably the material which is not absorbed after oral administration is either destroyed or excreted in the alimentary tract.

As it appeared that the destruction of penicillin by the acid of the stomach was not an entirely satisfactory explanation of the fate of the larger part of the ingested material, an investigation of the absorption, excretion, and destruction of penicillin following oral administration has been conducted, and a preliminary report on certain of the observations is presented at this time.

A study of the urinary excretion of penicillin after both oral and intramuscular administration was made in six subjects with complete achlorhydria. Five of the subjects had pernicious anemia. On successive days, each subject received identical doses of penicillin by the oral and by the intramuscular route. Nine such experiments were performed, seven after 300,000-unit doses and two after 25,000-unit doses. The penicillin determinations were made by the Rammelkamp method of bio-assay (*10*). All subjects were in a fasting state when the penicillin was ingested and during the succeeding four hours.

The results are presented in Table 1. As may be seen, the amount of penicillin excreted in the urine (per cent of the total dose) ranged from 36 to 100 per cent following intramuscular administration, and usually was more than 60 per cent.[2] Following oral administration, the range of urinary excretion varied between 8 and 32 per cent. In the comparative studies in each individual, the differences are striking. The amounts of penicillin appearing in the urine of these achlorhydric subjects after oral administration were within exactly the same range as had been observed previously in normal subjects (*7*) and were definitely less than appeared after intramuscular administration.

TABLE 1

URINARY EXCRETION OF PENICILLIN FOLLOWING ORAL AND INTRAMUSCULAR ADMINISTRATION IN SUBJECTS WITH COMPLETE ACHLORHYDRIA

Subject	Penicillin dosage	Urinary excretion in per cent of total dose		Period of observation
	Units	Oral	Intramuscular	Hours
1	300,000	15		3
	300,000		46	5
	300,000	32	64	8
	25,000	19	100	8
2	300,000	28		8
	300,000		97	10
	25,000		36	8
3	300,000	21	68	4
	25,000	14	64	8
4	300,000	26	55	8
	25,000		52	8
5	300,000	10	96	8
6	300,000	27	73	24
7	300,000	8		3

Data on the urinary excretion of ingested penicillin obtained from the published reports and from our own observations are presented in Table 2. As may

[1] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Cornell University Medical College.

[2] The difference between the values for the urinary excretion of penicillin in these experiments and the 70 to 100 per cent excretion noted by Martin and Kirby is presumably because fewer dilutions of a given specimen of urine were assayed in the present experiments.

be seen, the maximum urinary excretion (and hence absorption) of ingested penicillin which has been observed in the achlorhydric subjects and in normal subjects regardless of vehicle (*3, 4, 5, 7, 8, 12, 13*) is only 34 per cent. Although in one report (*6*) not included in the table, higher values were obtained, a

TABLE 2

URINARY EXCRETION OF ORALLY ADMINISTERED PENICILLIN

Report	Dose (units penicillin)	Period of observation (hours)	No. of subjects	Vehicle	Protective agents	Per cent of total dose recovered	
						Average	Range
McDermott, Bunn, *et al.*	100,000–300,000	12–24	9		Absent	18.4	3–32
"	100,000–300,000	12–24	6	Magnesium trisilicate and amphogel	Present	16.5	6–29
"	100,000–300,000	12–24	16	Oil suspension of penicillin, alone or with beeswax or shellac	Present	9.9	2–21
Charney, *et al.*	25,000	6–8	25		Absent	12.8	4.2–21
"	25,000	6–8	18	1.4–7.0 grams trisodium citrate	Present	13.9–15.6	6.6–32
Free, *et al.*	100,000	6	4		Absent	20.2	8.8–33
"	100,000	6	3	10.0 grams $NaHCO_3$	Present	6.3	1.9–12
Heatley	15,000	7–8	3		Absent		4.2–13
"	27,500	7–8	1		Absent		13.3
"	15,000	7–8	3	Egg and $NaHCO_3$	Present	20.1	11.0–33
"	27,000	7–8	1	"	Present		18.0
Welch	100,000	7	10		Absent	6.7	Not stated
"	100,000	24	11	Amphogel adsorption	Present	13.6	5.5–21
"	100,000 in 4 divided doses		11	"	Present	7.2	1.2–15
Rammelkamp and Keefer	10,000	3	1		Absent		10.1
"	20,000	3½ (210 min.)	1		Absent		3.2
"	20,000	1½ (85 min.)	1	40 grams $NaHCO_3$	Present		5.3

repetition of the experiments (*5*) disclosed a maximum urinary excretion of only 33.8 per cent. A comparison of the extremes and the average values for the urinary excretion of penicillin ingested with and without acid neutralizing agents is of interest. With attempts at acid neutralization, the values for urinary excretion ranged from 3 to 33.6 per cent of the ingested dose, and the average values ranged from 6.7 to 20.2 per cent. Without attempts at acid neutralization, the values are from 1.9 to 32.5 per cent (extremes) and 6.3 to 20.1 per cent (averages). Thus, the range of urinary excretion of orally administered penicillin is of the same order of magnitude in subjects with achlorhydria as in normal subjects, regardless of whether attempts are made to neutralize the gastric acidity of the latter.

This suggests that the lower concentrations of penicillin which are attained in the blood and urine after oral, as compared with parenteral, administration are chiefly the result of a defect in absorption and not primarily due to penicillin lost by acid destruction. Presumably the penicillin which is not absorbed would be destroyed in the gastrointestinal tract or excreted in the stool.

In several experiments a variable amount of an antibacterial substance, presumably penicillin, was extracted from the stools of subjects who had ingested single large doses of penicillin, but was not present in the stools of the same subjects after the intramuscular administration of penicillin. Since the amount of penicillin present in the stools represented only a small fraction of the ingested dose, it appeared probable that the destruction of a large part of the material which was neither absorbed nor excreted occurred distal to the duodenum, in the lower ileum or colon.

In the original report on the pharmacology of penicillin by Abraham, *et al.* (*2*), it was mentioned that feces inactivate penicillin, but no details were presented. Subsequently it was established (*1*) that a penicillinase could be extracted from *E. coli*. Since no information was available on the rate of the inactivation of penicillin by feces, known amounts of penicillin were incubated *in vitro* at 37° C. with emulsions of stool specimens from presumably normal individuals. The technique used for the assay of penicillin in feces is described elsewhere (*8*).

The results of five representative experiments are presented in Fig. 1. As may be seen, 80 to 100 per cent of the penicillin was inactivated by incubation

with emulsion of stool for 24 hours. No inactivation was demonstrable in one experiment which was continued for only four hours. In general, the rate of inactivation varied, but considerable destruction had

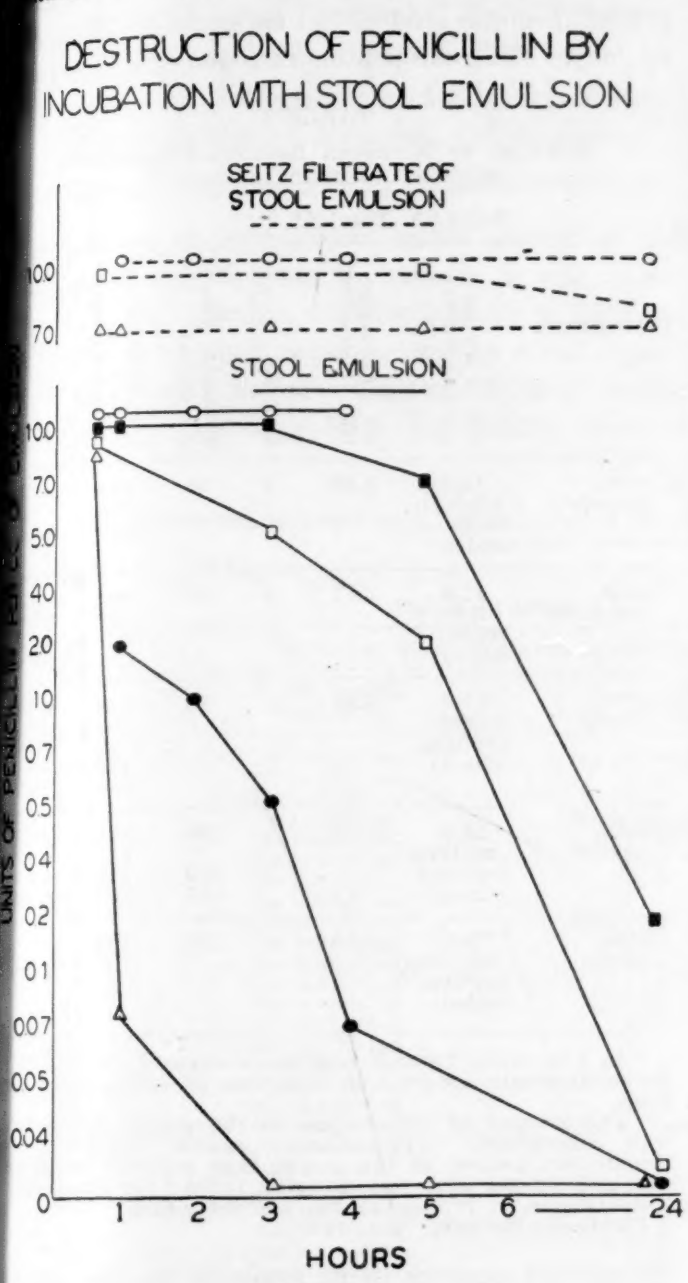

FIG. 1

usually occurred by the end of the third hour of incubation. When emulsions of stool were passed through a Seitz filter prior to incubation with penicillin, little or no destruction of the penicillin occurred, although unfiltered specimens from the same emulsion destroyed penicillin.

Thus, there are two mechanisms for the destruction of penicillin in the alimentary tract: the secretion of acid in the stomach and some agent, presumably bacterial, in the intestine. It is impossible to determine in an individual case the relative proportions of an ingested dose of penicillin which are destroyed by these respective mechanisms. One operates before, the other after, the penicillin has reached the site of greatest absorption, the duodenum (*8*). Of greater importance, however, is the fact that even if destruction by acid does not occur at all, because of achlorhydria, successful neutralization, or the normal fluctuations of gastric acidity, the greatest absorption which has been noted is only 34 per cent of the ingested dose. The penicillin which is not absorbed is eventually destroyed by the action of the second mechanism or is excreted in the feces.

It appears, therefore, that the maximal benefit which is attainable from protecting the penicillin against acid destruction is limited to the difference between the amount of absorption which occurs in the absence of such protection and the maximal absorption which has been noted when acid destruction is not a factor. As the theoretical advantage of protection of all of the material against acid is so largely counterbalanced by the fact that no more than a third of the ingested dose is absorbed in any event, it would seem that no penicillin preparation for oral use which is based solely on the principle of protection against acid will prove to be significantly superior to penicillin alone.

Furthermore, in the presence of maximum absorption approximately three times as much penicillin is required by the oral as by the intramuscular route to produce comparable penicillin concentrations in the blood. Since maximum absorption does not generally occur, the usual ratio of oral to intramuscular dosage will be in the neighborhood of 5:1.

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Effect of Penicillin on Growth of *Alcaligenes fecalis*

MACDONALD FULTON, CHARLES E. LANKFORD, and MARTHA CHILTON

University of Texas School of Medicine, Galveston

The literature contained no information on the effect of penicillin on *Alcaligenes fecalis* previous to a recent paper by Altemeier (*1*), who reported the marked susceptibility of five strains to penicillin. In

view of the well-known fact that gram-negative bacilli are in general relatively resistant to this antibiotic, it seemed advisable to test a larger number of strains of this species.

Nine strains of *Alcaligenes* were available in stock, six having been collected from human feces and three from human urine. The tests were carried out on Bacto Proteose No. 3 hemoglobin agar plates containing various concentrations of penicillin, as used routinely for tests of penicillin resistance in our laboratory. The plates were inoculated from young tryptose phosphate broth cultures by making a radial streak with the tip of an absorbent cotton swab dipped in the broth culture. They were examined after overnight incubation at 37.5° C.

In repeated tests no inhibition was observed at penicillin concentrations less than 10 units/ml. of agar. In a typical experiment, only one of the nine strains was inhibited by 10 units/ml. Fifty units inhibited another strain and almost completely inhibited a third. At 100 units, five of nine strains were still able to grow, although somewhat inhibited as compared with controls.

We have thus been unable to confirm the findings of Altemeier. Despite the fact that the genus *Alcaligenes* is now separated from the *Enterobacteriaceae* and grouped with other genera in the family *Rhizobiaceae,* it occurs with, and resembles physiologically, the members of the former family. The resemblances include insensitivity to penicillin.

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Intravenous Utilization of Partial Acid Hydrolysates of Proteins

William C. Risser, Jay R. Schenck, and Douglas V. Frost[1]

Abbott Laboratories, North Chicago, Illinois

Complete hydrolysates of casein fortified with tryptophane and cysteine monohydrochloride monohydrate were given intravenously to female dogs. The hydrolysates were given daily in one injection over a period of 80 minutes in some experiments and two hours in others. The minimum intake of nitrogen which maintained nitrogen balance was approximately 120 mg./N/kg./day. By the method of White and Elman (*1*) we have prepared partial acid hydrolysates in which approximately one-third of the amino ac exist in the free state. When these hydrolysates w fortified to the same content of tryptophane and c teine as employed in the complete hydrolysates, nitr gen balance was produced at an intake of 120 mg./N kg./day. Thus, the peptide nitrogen of a partial ac

TABLE 1

Summary of Nitrogen Balance Experiments

Hydrolysate	Total N* Wt. of tryptophane present†	Total N* Wt. of cysteine $HCl \cdot H_2O$ added	Dog No.	Injection time (minutes)	Intake of hydrolysate in mg./N/kg./day	Balance in Five-day Periods‡
Casein, complete	12.0 (dl-tryptophane added)	4.90	1	80	100	−0.9
					80	−0.9
					120	−0.4
Casein, complete	12.0 (dl-tryptophane added)	3.31	2	80	100	−1.3
					80	−0.9
					120	+0.2
Casein, partial	11.0 (l-tryptophane added)	4.83	1	80	120	+0.2
					100	−0.3
					80	−0.6
			2		120	−0.1
					140	+0.5
Casein, partial	25.0 (no tryptophane added)	4.83	3	80	140	+0.7
				"	140	+0.2
				100	120	+0.1
				90	100	−0.0
Fibrin, partial	9.0 (no tryptophane added)	14.06	4	120	100	+1.0
					100	−0.1

* In this ratio, Total N represents nitrogen (in grams) of the hydrolysate before any additions of amino acids were made.

† The amount of tryptophane in the partial hydrolysates was determined. "Tryptophane present" represents the amount (in grams) of the tryptophane retained in the partial hydrolysate plus the quantity added; for the complete hydrolysates, it represents the amount added.

‡ Five-day periods.

hydrolysate appears to be available for the purpose of maintaining nitrogen balance in the adult dog when the hydrolysate is given intravenously.

The nonprotein diet consisted of 73 grams sucrose, 20 grams lard, 3 grams corn oil, 0.5 gram fish-liver oil containing 65,000 U.S.P. units of vitamin A and 13,000 U.S.P. units of vitamin D per gram, 4.0 grams U.S.P. salt mixture I, 0.2 gram choline chloride, 1.0 gram agar, 0.6 mg. thiamine hydrochloride, 0.6 mg. riboflavin, 12.0 mg. nicotinamide, 0.4 mg. pyridoxine, 1.2 mg. calcium pantothenate, and a liver concentrate low in nitrogen but rich in vitamin B_c. The amount of this diet consumed usually supplied considerably less than 5 per cent of the total nitrogen intake.

Reference

1. White, A., and Elman, Robert. *J. biol. Chem.*, 1942, **143**, 797.

[1] With the collaboration of Robert T. Olsen, Oscar H. Walther, and Everett W. Doede.

The authors wish to thank Dr. E. H. Volwiler, Mr. Carl Nielsen, and Dr. D. W. MacCorquodale for encouragement and counsel in the course of this work, and to acknowledge the cooperation of Mr. H. C. Spruth in various phases of the problem.

he Presence in Normal Serum of hibiting Substances Against *acillus subtilis*[1]

. W. Buggs, Bernice Bronstein, John Winslow Hirshfeld, and Matthew A. Pilling

Departments of Bacteriology and Surgery, Wayne University College of Medicine, and *Receiving Hospital, Detroit, Michigan*

In initiating an investigation of the absorption and xcretion of streptomycin in humans, it was necesry to find an organism whose sensitivity to the antiotic was such that it could be used as a test organm in determining the concentration of streptomycin body fluids. *Bacillus subtilis,* No. 4R6259, received from the Merck Institute, appeared to have the required sensitivity and was selected for use in the study.

Before administering the streptomycin to patients chosen for the study a sample of blood was drawn from each as a control. In the first series of tests it was found that the serum inhibited the growth of *Bacillus subtilis* in dilutions varying up to 1:32.

Because of these findings, a titration of serum from 35 normal individuals was made in order to determine to what extent these inhibiting substances occurred. The sera were also tested to learn if inhibiting antibodies were present for a strain of *Staphylococcus aureus* (No. 209 P of the Food and Drug Administration). Unheated serum and serum inactivated at 56° C. for 30 minutes were used. Table 1 summarizes the results.

Thirty out of 35 of the sera inhibited the growth of *Bacillus subtilis,* while 5 of them failed to inhibit this organism. After inactivating the serum at 56° C. for 30 minutes, 10 of the sera lost their ability to inhibit, 15 partially lost their ability by a reduction in titer, and 4 were uninfluenced. (One sample, No. 32, was not tested in the inactivated state.)

TABLE 1

Titration of Inhibiting Substances in Normal Serum for *Staphylococcus aureus,* No. 209 P, and for *Bacillus subtilis,* No. 4R6259

Serum No.	Unheated serum		Serum heated 30 min. at 56° C.	
	Dilution at which organism is inhibited		Dilution at which organism is inhibited	
	Staph. aureus No. 209 P	*B. subtilis* No. 4R6259	*Staph. aureus* No. 209 P	*B. subtilis* No. 4R6259
1	No inhibition	No inhibition	No inhibition	No inhibition
2	No inhibition	1:2	No inhibition	Undiluted
3	No inhibition	1:8	No inhibition	1:2
4	No inhibition	No inhibition	No inhibition	No inhibition
5	No inhibition	1:32	No inhibition	1:32
6	No inhibition	1:8	No inhibition	1:4
7	No inhibition	1:8	No inhibition	No inhibition
8	No inhibition	1:4	No inhibition	No inhibition
9	No inhibition	No inhibition	No inhibition	No inhibition
10	No inhibition	1:8	No inhibition	1:4
11	No inhibition	1:4	No inhibition	1:2
12	No inhibition	1:4	No inhibition	1:2
13	No inhibition	Undiluted	No inhibition	No inhibition
14	No inhibition	1:4	No inhibition	1:2
15	No inhibition	1:4	No inhibition	1:2
16	No inhibition	1:8	No inhibition	No inhibition
17	No inhibition	1:8	No inhibition	1:2
18	No inhibition	1:8	No inhibition	No inhibition
19	No inhibition	No inhibition	No inhibition	No inhibition
20	No inhibition	1:2	No inhibition	No inhibition
21	Not tested	1:8	Not tested	No inhibition
22	No inhibition	1:2	No inhibition	No inhibition
23	No inhibition	1:4	No inhibition	No inhibition
24	No inhibition	1:8	No inhibition	1:4
25	No inhibition	1:8	No inhibition	1:2
26	No inhibition	1:8	No inhibition	1:2
27	No inhibition	1:4	No inhibition	1:2
28	No inhibition	No inhibition	No inhibition	No inhibition
29	No inhibition	1:2	No inhibition	1:2
30	No inhibition	1:2	No inhibition	No inhibition
31	No inhibition	1:4	No inhibition	1:2
32	Not tested	1:2	Not tested	Not tested
33	No inhibition	1:2	No inhibition	1:2
34	No inhibition	1:4	No inhibition	1:2
35	No inhibition	1:4	No inhibition	1:4

Two additional strains of *Bacillus subtilis* were tested in 5 of the sera listed in Table 1. Both of them were inhibited by each of these sera. The 5 sera which failed to inhibit strain No. 4R6259 were not tested for inhibiting substances against these 2 additional strains.

Thirty-three of the sera were tested against *Staphylococcus aureus,* No. 209 P. None of them possessed inhibiting substances against this organism. Some of the sera were tested against several other strains of

[1] The work described in this paper was supported by grants from the Theodore A. McGraw Fund and from Merck and Company, Rahway, New Jersey.

staphylococci, but in no instance were inhibiting substances demonstrated.

Randall, Price, and Welch (*2*) have suggested the use of *Bacillus subtilis* as a test organism in assaying penicillin in various body fluids by a modification of the dilution method of Rammelkamp (*1*). This organism was proposed because of the ease with which it may be cultivated, the sharp reproducible end-points said to be obtained, and because its use obviates the employment of washed erythrocytes as required in the Rammelkamp technic. These investigators did not state, however, whether or not serum obtained from patients before the administration of penicillin inhibited their test organism.

The data presented in this paper would indicate that the results of any assay of serum for an antibiotic, using *Bacillus subtilis* as the test organism, are open to question, unless, prior to the administration of the antibiotic, the serum has been tested for the presence of natural inhibiting antibodies.

Summary: Sera from 35 normal persons who had received no previous medication were tested for inhibiting substances against *Bacillus subtilis* and *Staphylococcus aureus*. Thirty of the sera (85 per cent) inhibited *Bacillus subtilis* in dilutions varying up to 1:32, but in no instance was *Staphylococcus aureus* inhibited. The data presented would indicate that *Bacillus subtilis* is not a suitable organism for use in the assay of antibiotics in the presence of serum.

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2. Randall, W. A., Price, C. W., and Welch, H. *Science*, 1945, **101**, 365–366.

Preliminary Studies on the Absorption and Excretion of Streptomycin in Dogs

Boyd E. Graham, Milton J. Vander Brook, and Marvin H. Kuizenga
Research Laboratories, The Upjohn Company
Kalamazoo, Michigan

Pharmacologic studies on three lots of streptomycin, ranging in potency from 105 to 500 units/mg., were done on 14 male and female dogs. The animals were starved or fed a liquid diet for 24 to 48 hours prior to administration of streptomycin. They were divided into four groups. Only the dogs in Group 1 were anesthetized, and these experiments were acute. Intravenous (saphenous vein) administration was employed in Groups 1 and 2. The intramuscular (gluteal) route was used in Group 3 and oral administration (stomach tube) in Group 4. Urine samples were collected by catheterization from all dogs of Group 1, from one dog of Group 3, and from two dogs of Group 4. All other urines were collected via the metabolism cage.

Plasma volumes and streptomycin levels were calculated from haematocrit determinations. By one method of assay (*3*), using a paper disc-agar plate, neither plasma nor urine in a twofold dilution with 0.2-M phosphate buffer exerts an inhibitory effect on the test organism (*Bacillus subtilis*).

Results

In general, the rates of disappearance of streptomycin from the blood of anesthetized and unanesthetized dogs (Groups 1 and 2) following intravenous injections of 100,000 to 210,000 units were comparable. Only 18 to 29 per cent could be accounted for in the plasma during the period of 3 to 18 minutes postinjection. After 4 to 5 hours about 3 per cent could be detected in the plasma. The low total recovery of streptomycin (16 to 20 per cent of the amount injected) from the urines of the dogs in Group 1 may be due to the short experiment, or to anesthesia, since 45 to 65 per cent was recovered from the urines of Group 2. Approximately 35 to 55 per cent of the streptomycin injected was probably destroyed or inactivated. These results are in agreement with those found in humans (*1, 2, 4*). The purity of the three lots of streptomycin used apparently did not alter the results.

In Group 3, the highest plasma levels were 7.2 and 2.7 per cent of the injected amounts (100,000 units). These were reached after 1 and 1½ hours, respectively. After 5½ hours only a trace to 0.8 of one per cent could be detected. Therefore, the maintenance of plasma levels was no better with intramuscular than with intravenous injection. Only about 20 to 40 per cent of the stretopmycin administered could be recovered in the urines of this group.

In Group 4, streptomycin in doses from 210,000 to 420,000 units per dog could not be detected in the blood during the 24 hours following oral administration. The recovery in the urine of one dog of this group of 3.9 per cent of the drug administered, and lesser amounts in the others, indicates that streptomycin was absorbed to a small extent. The small percentage recovered in the urine is in agreement with the observations made on humans (*1, 2, 4*).

Summary

Streptomycin varying in potency from 100 to 500 units/mg. has been administered to 14 dogs intravenously, intramuscularly, and orally in amounts of 100,000 to 420,000 units.

High blood levels of streptomycin were observed ter parenteral administration and 23 to 65 per cent s excreted in the urine of normal dogs. After 4 5 hours only small amounts were detected in the od.

The maintenance of blood levels was no better with ramuscular than with intravenous administration.

Following the oral administration of as much as 0,000 units of streptomycin, it could not be detected the plasma, but up to 3.9 per cent was recovered om the urine.

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The Activity of Streptomycin in Experimental Syphilis

WOLCOTT B. DUNHAM and GEOFFREY RAKE

The Squibb Institute for Medical Research
New Brunswick, New Jersey

The striking therapeutic response following the reatment of syphilis with penicillin prompted the nvestigation of the action of streptomycin in experimental syphilis.[1]

Herrell and Nichols (*1*) have recently reported the results of the treatment of four cases of syphilis with streptomycin. Improvement was noted, but relapses occurred even after the administration of 10,000,000 units over a period of 10 days.

The technique employed in the present study will be described subsequently in full (*2*). A brief summary follows. Suspensions of rabbit testes infected with the Nichols strain of *T. pallidum* were employed to infect rabbits by intracutaneous injections in the clipped skin of the back. Commencing within three days, intramuscular injections of streptomycin or crystalline penicillin G[2] were made every four hours for four days. When lesions developed at the site of inoculation, their syphilitic nature was confirmed by dark-field examination for spirochetes. All other rabbits were kept for four months, at which time a suspension of the popliteal lymph nodes of each rabbit was injected intratesticularly in two rabbits. If the testes of these rabbits remained normal, the donor rabbit was judged to have been cured. The streptomycin preparations employed had potencies of 158 units/mg. to 229 units/mg.

A total of 79,000 units of streptomycin per kilogram of body weight protected one out of three rabbits. The three rabbits that received 650,000 units/kg. were also proved to have been cured. In another experiment, the lymph node transfers have not yet been made from the rabbits that have remained free of local lesions, but in the case of other rabbits that have been infected by the technique described above, lymph node transfers have not changed significantly the results obtained by reading the dermal lesions. In this experiment, none of the four rabbits in each of the groups that received 748,000 units/kg. and 374,000 units/kg. developed lesions. Of the four rabbits that received a total of 187,000 units/kg., three failed to develop chancres. A total of 93,500 units/kg. did not protect any of the four rabbits in this group. All control rabbits in each experiment developed typical lesions.

The smallest amounts of streptomycin that cured any of the rabbits when administered in divided doses during four days was 79,000 units/kg. (375 mg./kg.) in one experiment and 187,000 units/kg. (817 mg./kg.) in another. A similar effect was obtained with 147 units/kg. (0.088 mg./kg.) of crystalline penicillin G. It may be concluded, therefore, that the preparations of streptomycin employed have antisyphilitic action but that penicillin G is more than 3,000 times as effective.

References

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2. RAKE, GEOFFREY, and DUNHAM, W. B. (To be published.)

[1] The authors wish to express their appreciation to John J. Oskay for his technical assistance.

[2] Obtained through the courtesy of Dr. O. P. Wintersteiner and Dr. Max Adler, Division of Organic Chemistry, The Squibb Institute for Medical Research.

Scanning Science—

National University

The bill establishing a National University of the United States has been reported favorably by the Senate committee. It grants a charter to the University, provides for its government, grants it the ground in the city of Washington designated by President Washington as a site for a national university, and appropriates $15,000 for the fiscal year ending on June 30, 1897, and $25,000 for the year following.

Princeton University

At the recent meeting of the Board of Trustees of the College of New Jersey at Princeton it was voted to change the charter name of the institution to Princeton University. The fund which is being raised in commemoration of the Sesquicentennial next October is already over $900,000, a large proportion of which, it is said, will be devoted to the development of the graduate department.

—20 March 1896

News and Notes

Dr. John W. T. Spinks, professor of physical chemistry at the University of Saskatchewan, has rejoined the staff after two and a half years of operational research with the Royal Canadian Air Force and nuclear research at the laboratories of the National Research Council of Canada.

Dr. H. R. Gault, formerly of the U. S. Geological Survey, has been appointed an assistant professor of geology at Lehigh University.

Announcements

The Geological Society of Washington, comprising the professional geologists in the Washington area, adopted the following resolution at a meeting on 13 March, 1946:

We, the 400 members of the Geological Society of Washington, D. C., unanimously endorse the McMahon Bill, S. 1717, in its original form. We believe that no bill will provide a satisfactory domestic policy on atomic energy that does not provide for: 1. Full control over atomic energy development in this country by the Federal Government; 2. Complete civilian control through a Federal agency—the role of the military to be restricted to liaison in the field of weapons; 3. A policy of free publication and dissemination of scientific information, restricted only by the provisions of the Espionage Act.

We further believe that a bill lacking any of these features will stifle scientific progress and will, consequently, irreparably harm our civilization and greatly weaken the national defense.

The resolution was addressed to the President and the Congress. It marks a departure in the policy of the Society which has never heretofore concerned itself with legislative matters.

An annual award of $1,000 and a bronze medal for outstanding research in enzyme chemistry has been added to the list of awards administered by the American Chemical Society, according to Alden H. Emery, national secretary of the Society. The new award is sponsored by the Paul-Lewis Laboratories, Inc., of Milwaukee, Wisconsin, and will be known as the Paul-Lewis Laboratories Award in Enzyme Chemistry. The first award will be presented by the Society in April to one of a group of candidates now under consideration by a special committee.

McGill University has announced a recently created Department of Anaesthesia. The chief objectives are to improve the teaching of anaesthesia to the undergraduate students in Medicine; to increase the opportunities for learning anaesthesia among the internes of the hospitals connected with the University to conduct a three-year Diploma Course in Anaesthesia; and to develop investigation in anaesthesia in the clinic and in the laboratory from the point of view of interrelationship, and in an interdependent fashion with the University's other departments. This development comes on the centenary of the discovery of anaesthesia.

Dr. F. A. Vening Meinesz, professor of geophysics at the University of Utrecht, director of the Royal Netherland Meteorological Institute, and recent recipient of the Penrose Medal of the GSA, gave a series of four lectures at the invitation of the University of Cincinnati Chapter of Sigma Xi and the Department of Geology and Physics. The subjects discussed were "Gravity Anomalies in the East and West Indies," "Tectonic Patterns of the Ocean Floor and Their Interpretation," and "Newer Conceptions of Isostasy and Crustal Structure in the Light of Gravity Determinations." The illustrated public lecture on "Weighing the Earth From a Submarine" was followed by informal talks to faculty and student groups on "The Resistance Movement in Holland During the Occupation" and "The Danger of a Spiritual Vacuum in a Scientific Age."

Additional AAAS Meeting Notes

Headquarters for the Press will be in the Kiel Memorial Auditorium. Dr. Sidney S. Negus, Medical College of Virginia, Richmond, will be in charge.

The National Association of Science Writers will meet in Private Dining Room No. 7 of the Jefferson Hotel at 7:45 P.M., 27 March.

The St. Louis housing situation is still desperate. The most recent development is that a request from Dr. F. R. Moulton in the name of the Association to the Secretary of War for 1,500 berths in the Jefferson Barracks, Missouri, has been denied.

Recent Deaths

Ulphian Carr Loftin, 55, for the past 15 years assistant head of the Division of Cotton Insect Investigations in the U. S. Department of Agriculture's Bureau of Entomology and Plant Quarantine, died on 16 January in Washington, D. C.

Dr. Charles Theodore Burnett, 72, professor of psychology at Bowdoin College, died at Brunswick, Maine, on 31 January. He had retired in 1944, but had continued to teach to augment a war-depleted faculty.

Science Exhibition

(*Continued from 1 March issue.*)

Ace Glass, Incorporated

Vineland, New Jersey
Booth No. 125

In our effort continually to widen the scope and application of our spherical joints, we are now exhibiting and applying these joints in new sizes and in different materials other than pyrex glass. The new sizes, namely, 50/25, 75/50, 102/75, and 130/90, will make it possible to have spherical connections on glass pipe and large-size glass tubes and still have the same flexible, nonfreezing, and interchangeable features of our standard line. The standard line of joints will be available in stainless steel and clear fused quartz. The new sizes listed above will be available in metal only. These joints will all be interchangeable so that installations having metal lines can be clamped together with the glass just as readily as the regular glass joint. In order to facilitate clamping of these joints we are going to feature our new-type clamp, which will be radically different from any offered on the market today. One of the features of our exhibit will be a large pilot plant-size evaporator, constructed entirely of pyrex glass from the stopcock manifold to the heat exchanger tubes. It will be possible to operate it continuously or for batch operations, both at atmospheric or lower pressures. In addition, there will be many smaller items, such as the split flask, or resin flask, from 500 ml. to 5,000 ml.; the light oil pycnometer, now tentative ASTM No. ES45; various distilling columns, such as the Penn State Semi Micro Column, which has a column length of but 11″ and a separating power of 50 plates.

Bausch & Lomb Optical Company

Rochester, New York
Booth No. 134

This exhibit includes a stereoscopic polarizing device of new design, laboratory microscopes, wide field stereoscopic microscopes, micro-projectors, and Balopticons. The new B & L Stereo Polarizer produces stereoscopic vision through monobjective laboratory microscopes with binocular eyepieces. This is accomplished by a split-field polarizer, showing halves of the field polarized at right angles to each other, and two eyepiece analyzers, each of which can be aligned with one-half of the polarizer field. The B & L CTA Microscope has inclined binocular eyepieces, Abbe condenser, mechanical stage, and other accessories for advanced microscopy. A simpler model, the Bausch & Lomb BA Microscope has a monocular body but is otherwise similar to the CTA. Models A and FB are simpler microscopes designed primarily for educational use. The B & L BKW Stereoscopic Wide Field Microscope shows objects right side up in three dimensions. Fitted with a revolving drum nosepiece, it affords instantaneous change of magnification. The B & L B Micro-Projector utilizes any standard laboratory microscope. Since the stage is always horizontal, this projector is well adapted to showing living or wet mount specimens. Combining opaque and slide projection, the LRM Balopticon projects quiz papers, book pages, slides, solid objects and other material.

Biological Abstracts

University of Pennsylvania
Booth No. 130

A cooperative, nonprofit journal published by biologists for biologists. *Biological Abstracts* is the only abstracting and indexing service in the world that affords an adequate coverage of the literature in all fields of biology. Currently abstracting some 2,300 journals, the coverage is being expanded as rapidly as possible to include the many European and Scandinavian journals that have not been available to the scientists of this country since the outbreak of the war. *Biological Abstracts* is published not only in the complete edition but also in eight low-priced sectional editions specially designed for individual biologists who are interested only in one or more closely related fields. These sectional editions will be on display, and Dr. John E. Flynn, editor-in-chief, and H. I. Anderson, business manager, will be in attendance to welcome visitors and furnish information.

Distillation Products, Inc.

Rochester, New York
Booth No. 152

Users of high-vacuum equipment looking for the latest and best in vacuum producing, measuring, and controlling units will find a complete display of fractionating diffusion pumps, vacuum gauges, and high-vacuum valves at the Distillation Products exhibit. Featured here, in operation, will be vertical metal fractionating diffusion pumps—ranging in capacity from 2 l/sec. to 260 l/sec.—which mark an entirely new and highly efficient principle in the production of low pressures. Recent developments in high-vacuum valves—which provide greater control with lower impedance—are to be represented by especially designed valves in the 2″ and 4″ sizes plus a solenoid valve for ¾″ lines. The latest models of D.P.I.'s newest gauges, which include those of the Knudsen, Philips, Pirani, and Ionization-type, will also be on display. This group of gauges provides a series capable of accurately reading pressures from .00000001 mm. to 1 mm. of mercury. Design changes which make the new gauges of particular interest to industrial and laboratory users include the following: The Knudsen gauge has been improved so that satisfactory operation can be obtained under normal factory conditions of vibration; the Philips gauge has been constructed to give readings from 25 microns to 2×10^{-5} mm., and yet is so built that it will not be damaged by accidental exposure to atmospheric pressure; the Pirani gauge has been stabilized with re-

spect to voltage and made into a continuously recording gauge for the range of 0 to 1000 microns; the familiar type of hot filament ionization gauge has been equipped with a new type of flexible control for use between 1-micron and below 10^{-6} mm. Hg. In addition to the equipment described above, examples of other gauges and D.P.I.'s two- and three-stage glass fractionating pumps for obtaining extremely low pressures without cold traps will be shown. Information and illustrative material will also be available on larger diffusion and ejector-type vacuum pumps, high-vacuum evaporating equipment, and stills for high-vacuum distillation.

J. H. Emerson Company

Cambridge, Massachusetts
Booth No. 111

In this booth will be shown the Emerson micromanipulator, which operates on a lever principle so that the motion of the lever which controls horizontal motions of the needle is identical with the apparent motion of the operating needle in the field of a compound microscope. This feature makes possible much more rapid control of the needle and makes it easier for an operator to learn to use the machine. There will also be shown the Emerson model of the Barcroft-Warburg apparatus. The J. H. Emerson Company was first to manufacture this apparatus continuously ever since. Literature will be available on the medical line of equipment manufactured by the company including "iron lungs, resuscitators, oxygen humidification apparatus, hot pack apparatus, fever therapy apparatus, and a new device for treatment of tuberculosis by means of lung immobilization."

E. Leitz, Inc.

New York, New York
Booth No. 148

This exhibit will include the following instruments: the *Leitz Photo-electric Precalibrated Colorimeter,* an instrument used for colorimetric determinations of human body fluids; the *Leitz Photo-electric Hemoglobinometer,* a portable instrument designed for use by individual practitioners so that they can make rapid colorimetric determinations of the hemoglobin content of the blood stream; the *Leitz G & D Electric Titrator,* an instrument used to determine by electronic means the end-point of a chemical titration; the *Leitz Magarc,* a completely automatic carbon arc microscope lamp giving a highly intense source of illumination; the *Leitz Microlux,* a Universal Microscope lamp used for visual observation, photomicrography, and microprojection; the *Leitz Micam,* a camera attachment which will fit any microscope accommodating standard eyepieces, produces a $3\frac{1}{4} \times 4\frac{1}{4}$ negative, and may be used for making black-and-white or Kodachrome photomicrographs; the *Leitz Micro-Manipulator,* an instrument permitting manipulation of specimens during microscope observations; *Leica* camera accessories —American made lenses, view finders, and other devices for use in scientific photography.

Mallinckrodt Chemical Works

St. Louis, Missouri
Booth No. 55–56

"Research and Development for Today and Tomorrow" will be featured with an exhibit of a variety of new organic products as a consequence of fundamental researches by Mallinckrodt chemists on ester condensations. Among samples available for inspection will be oxazolidones, malonic esters, and higher alkyl carbonates such as dicetyl carbonate and dioctadecyl carbonate. Phenylacetic acid and phenylacetic ester also will be exhibited. In addition to the above compounds, the exhibit will include pyridylmercuric acetate, pyridylmercuric chloride, and pyridylmercuric stearate, which are effective fungicides and mildew-proofing agents. These compounds may be incorporated in textiles, felt, leather, coatings, paints, wood, rubber, resins, and waxes. Mallinckrodt Chemical Works is cited in the Smyth report on atomic energy for having achieved in production "a degree of purity seldom achieved even on a laboratory scale." This achievement was in part possible because of many years of fundamental research and long experience in the production of analytical reagent, medicinal, photographic and high-purity industrial chemicals. Examples such as Mallinckrodt Analytical Reagents and Primary Standards, universally known for uniform, dependable purity, will be exhibited. The high purity of these reagents is of specific interest to, and meets the exacting requirements of, research and clinical laboratories.

Merck & Company, Inc.

Rahway, New Jersey
Booth No. 123–124

The enormous success of penicillin in helping in the treatment of war injuries and diseases has made the chemotherapeutic importance of the newly investigated antibiotics of great scientific and public interest. The House of Merck has been in the forefront of antibiotic research in the United States from the early collaboration in the large-scale investigation of gramicidin in 1939 through the wartime development of penicillin, to its more recent interest in the newest antibiotic, streptomycin, discovered by Waksman in 1944. This exhibit, devoted entirely to the Story of Streptomycin, will show briefly the commercial history of the better-known antibiotics and trace the processing of an antibiotic from the parent organism to the pure crystalline compound. A brief resumé of the presently known chemistry will be outlined, and following an account of its pharmocological properties, the proposed clinical uses of this chemotherapeutic agent are briefly listed. By means of illuminated transparencies below the background panels of the exhibit are to be shown the parent organism, *Streptomyces griseus*; the crystalline forms of streptomycin compounds; and culture plates demonstrating the action of the drug on various pathogenic organisms.

National Roster of Scientific and Specialized Personnel

Washington, D. C.
Booth No. 138

he National Roster is a division of the U. S. Employ- t Service, Department of Labor. The functions of National Roster are to maintain a national central istration of the Nation's scientifically trained person- to provide a placement service for scientific profes- al personnel and employers of such personnel, and erve generally as a clearing house of information con- ing the sciences and professions. At present a major tion of the Roster's placement efforts are devoted to ting suitable civilian positions for returning veter- qualified in the professions. During the war the ter's efforts were devoted almost entirely to the bilization of scientific and technical personnel in both ilian and military positions and participation in the erment program. The Roster's exhibit will include ies of its various occupational publications and statis- l information on various professions, and will show the Roster's work is carried on. A representative of National Roster will be present to answer questions provide information.

St. Louis University Biology Department and Biodynamic Laboratory

St. Louis, Missouri
Booth No. 42

Study of ultrarapid cooling. When a substance which tains water is cooled very rapidly—that is, at a veloc- of several hundred or a thousand degrees F. per sec- d—ice cannot form freely in it. Either no ice is rmed or very little, depending on the velocity of cool- g and on the amount of foreign material dissolved in e water. There is some evidence that such rapid cooling es not harm living beings. Prof. B. Luyet, of St. Louis niversity, and Dr. P. M. Gehenio, of the Biodynamic esearch Laboratory, have developed methods for record- ng the quantity of ice formed during ultrarapid cooling droplets of solutions or of body fluids several hundred imes smaller than those delivered by a medicine drop- r. Small organisms were also investigated. The ex- hibit will include a demonstration of the methods and a presentation of the apparatus and the records.

Science Illustrated

New York, New York
Booth No. 72

This booth is designed as a general meeting place for those who are attending the Association's meetings to get together and discuss the various aspects of the advent of the new mass magazine, *Science Illustrated,* the purpose of which is to report the developments of the sciences to the general public and to describe their consequences in terms of daily living. Dr. Gerald Wendt, editorial director, will be on hand personally a good part of the time; and other members of the magazine's staff will be in constant attendance, ready to answer questions and demonstrate the editorial aim of this new magazine, illustrating from copies of the first issue which will be rushed from the press to the convention several days in advance of issue date.

Science Service

Washington, D. C.
Booth No. 131–132

The exhibit will show the variety of work done by Science Service in the popularization of science. This includes services to newspapers—*Daily News Report, Wire by Mail, Science Page, Your Health—Here's How, Star Map, Science Shorts,* and *Isn't It Odd?*; *Science News Letter,* the weekly summary of science covering new developments in 137 science subject classifications; *Chemistry,* the monthly magazine of new developments in chemistry, edited to serve intelligent laymen, industrialists, teachers, and students of science; *Things of Science,* the monthly kits of practical exhibits, experimental materials, and instructional information in what is new in science; *FUNdamentals of Science,* the kits designed for 10- to 15-year-old experimenters, containing all the apparatus necessary for carrying out dozens of experiments, for which careful directions are given; books edited and published by Science Service; magazine articles by members of the staff; *Science Clubs of America,* the materials now being sent at no cost to the more than 9,000 sponsors of clubs affiliated with Science Clubs of America, the international organization for young scientists, which now numbers more than 200,000 members; *The Annual Science Talent Search* for the Westinghouse Science Scholarships, conducted by Science Clubs of America, which is an open competition to high school seniors; *Science Clubs of America Cooperators,* the work of the 32 cooperating organizations now working with Science Clubs of America to provide opportunities for young scientists in 28 states; *Adventures in Science,* a weekly nation-wide broadcast by Science Service over the Columbia Broadcasting System, a portion of which is devoted to an open meeting of Science Clubs of America; and *Science News of the Week,* a compilation of the scientific developments of the week which is prepared for use by any radio station. Members of the staff of Science Service who will be present at the meeting include: Watson Davis, director; Dr. Frank Thone, staff writer in biology; Miss Jane Stafford, staff writer in medicine and health; Miss Marjorie Van de Water, staff writer in psychology; and Miss Margaret E. Patterson, secretary, Science Clubs of America.

Letters to the Editor

A Plea for Stabilized Progress

Government inevitably reflects the mind of Main Street. Among the laymen, and therefore in government circles, the practical aspects of atomic fission appear to have produced four characteristic, if not correlative, reactions: (1) a vague, yet realistic, fear; (2) concomitant or subsequent attempts to escape from reality by clinging to national and local tradition; (3) a consuming interest in the mechanics and destructive potentialities of the bomb; and (4) futile gestures toward keeping secret the methods of manufacture and design.

There is considerable likelihood that these elements of reaction may combine to swing the pendulum of science from obscurity to sustained and revered leadership. Scientists may be lavished with all the respect and eulogy previously accorded generals. It is pertinent, therefore, that we be prepared to advise the public politically before the first limelight fades. Profs. Einstein, Urey, and others have already indicated the dire necessity for world government as the only plausible defense against the atomic bomb. But how to implement a solution of the social and organizational problems involved? We vaguely and categorically satisfy ourselves with the ends and leave the means to "society," "politics," or other social abstraction.

Our logical co-worker in this regard is the social scientist, for his background consists of the history of human relationship and a knowledge of present social conditions and trends. His equipment for dealing with outworn and positively dangerous traditional thinking should be ideal. Perhaps he can shed light on the problems necessarily accompanying, and peculiar to, the establishment of permanent peace.

Raymond E. Bassett (*Science*, 1946, 103, 25–26) confirms the similarity of method inherent in sociological, and in physical, biological, and medical investigations. Mutual cooperation, therefore, could be maintained on a common footing to the ultimate satisfaction of both groups, and a coordinated solution to world problems might be effected.

In order that science may proceed on a comprehensive and safe basis, it seems not unreasonable to suggest for the two scientific groups a 50–50 relationship. This would involve an equal sharing of government appropriations, a more equitable distribution of offices within the more broadly constructed scientific societies and organizations, and unremitting requests to the public and Government for impartial support of scientific projects, regardless of social or physical classification.

Unfortunately, with the rapid and not always well-deliberated shifting of public opinion, physical science may become a disproportionate public fad, and the social scientist may be lost in the shuffle.

R. J. CORDELL

Minersville, California

Broadcasting Congressional Sessions

A continuous radio broadcast of all open Congressio proceedings would do more than almost anything else intelligently arouse, enlighten, and interest the Americ people in the preservation of the American way of li

We have the technical power to place a microphone every congressman's desk and provide a place on o radio bands for democracy in action at its roots. T cost involved would be trivial compared to the value our country.

If those men of science who approve of this plan wou approach their governmental representatives and ra executives and interest their friends in doing likewis considerable influence would be directed towards the a tainment of a continuous radio broadcast of all Congre sional sessions.

MAURICE J. KELLEY and RALPH G. SCHAUBEL

Industrial Research Laboratory
National Oil Products Company
Harrison, New Jersey

Federal Aid for Scientific Research

The importance of federal aid for scientific research i again stressed by publication in the *New York Time* (14 February) of a "top secret" letter from Germa Grand Admiral Karl Doenitz admitting, in the fall o 1943, that American and British scientists had defeate the U-boat campaign through "superiority in the fiel of science." He said: "It is essential to our victor that we make good our scientific disparity and thereby restore to the U-boat its fighting qualities."

While scientists are practically unanimous in favorin federal aid for research, many are apt to be misled b idealistic declarations in the preambles of proposed legis lation or in the statements of Committees, and thereupon assume that whatever the bill itself proposes, or the small executive group of the Committee decides upon, will really be helpful in attaining the ideals advocated. While nominally having the right of criticism, many, if not most, of these well-meaning persons fail to consider in detail what is actually expressed or implied in a bill, and may thus find themselves used as "rubber-stamp" sponsors for practical results which, on sober reflection, they would abhor.

After securing a copy of the bill S. 1720 and making a careful analysis of it, I read (*Science*, 1946, 103, 161) that S. 1720 is undergoing final redrafting; so that per haps my comment may be moot. But I cannot take the naive view (expressed in *Science*, 1946, 103, 104) that techniques of administration are unimportant. As I understand it, S. 1720 places very great power and financial patronage in the hands of appointees and appointees of appointees. Even though Sec. 4 (f) of S. 1720 says that all "officers and employees of the Foundation, shall be chosen without regard to their political affiliations

solely on the basis of their demonstrated capacity to y out the purposes of the Foundation and their fit- to perform the duties of their office,'' even scien- should know enough of practical politics to realize t those making appointments can always find ''fit'' ons among the ''deserving'' of their political views. fine objectives of this movement for federal aid to nce might easily be perverted or even blocked should control of the funds or their administration get into hands of the wrong persons. Selection of key per- nel by nonpolitical scientific groups is a wise and even ential safeguard. The Federal government already many thousands of scientists in its employ—about 000 according to the last estimate I saw.

JEROME ALEXANDER

East 41st Street, New York City

Support of a September Meeting of the AAAS

We wish to add our support to the suggestion made by of. R. S. McEwen (*Science*, 1946, 103, 178) that the AAS meetings be held at a season other than the ristmas holidays. As Prof. McEwen says, attendance winter meetings is usually made disagreeable by bad ather, crowded trains, colds, and disrupted family therings. Furthermore, there is no reason why biolo- ists should have to spend their short winter vacation ttending scientific meetings, while chemists, physicists, nd various other professional groups schedule and at- nd their meetings with little regard for college teach- ng schedules. On the whole, it seems that early Sep- mber might be the best time for a meeting. An objec- ion might be raised by some biologists who work up the esults of their summer's research during the autumn and present them at the winter meetings, but this objection is minor and could usually be overcome. Let us give serious consideration to Prof. McEwen's suggestion and try an- other September meeting.

RUTH M. ADDOMS, LEWIS E. ANDERSON, H. L. BLOMQUIST, PAUL J. KRAMER, HENRY J. OOSTING, H. W. PERRY, and F. A. WOLF

Duke University

Radio Echoes From the Planets

The recent announcement of the reception of radar echoes from the moon have aroused interest in, and raised inquiries concerning, the absorption of microwaves by those gases which are present in the atmospheres of the various planets. A general investigation into the microwave absorption has been made at these Laboratories and some results presented before the New York section of the American Physical Society (*Phys. Rev.*, 1945, 68, 284). It was found that of the 50-odd substances which are gases at room temperature and pressure, 15 strongly absorb microwaves. Absorption may be characterized as either resonant or nonresonant. In methyl fluoride the absorption is largely nonresonant. At a wave length of 1.0 cm. this gas at normal temperature and pressure will reduce the power in a plane wave by 50 per cent for each 23 feet of gas traversed by the wave. At 3.0 cm. the absorption is 75 per cent as large as it is at 1.0 cm. Ammonia, on the contrary, exhibits resonant absorption, with the maximum in the curve under the above conditions occurring at 1.25 cm. while at 3.0 cm. absorption falls to 20 per cent of its maximum value. This gas is found in the atmospheres of both Jupiter and Saturn. It might be thought that considerable information would be given by varying the frequency of the radar transmission, but this is not the case. Owing to the high gas pressures found on these planets and the presence of other nonabsorbing constituents in their atmospheres, the width of this absorption region is so great that it is likely that both microwaves and waves in the ultra short radio spectrum will be totally absorbed in the atmospheres surrounding these planets. The transmission paths involved in radar sounding are so great that a very small absorption coefficient will give rise to total extinction. The results of further radar experiments should prove of value in increasing our knowledge of the constitution of planetary atmospheres.

For the information of those who are interested, the list of gases showing large absorption for microwaves includes the methyl and ethyl halides, the gases known commercially as Freon, three of the amines, ammonia, and sulphur dioxide. In fact, all nonplanar molecules having a dipole moment which have been tested thus far in the Laboratory show strong absorption in the microwave region, and in general this absorption is of the nonresonant variety.

W. D. HERSHBERGER

RCA Laboratories, Princeton, New Jersey

Competition Between Two Entomogenous Bacteria

The antibiotic activity of *Bacillus larvae*, the causal organism of American foul brood of the honeybee, was recently reported by E. C. Holst (*Science*, 1945, 102, 593–594). A phenomenon suggesting antibiotic activity is to be found in two other entomogenous bacteria, *Bacillus popilliae* Dutky and *Bacillus lentimorbus* Dutky, the causal organisms of two types of milky disease of Japanese beetle larvae. The vegetative forms of these two bacteria are similar in appearance, but the spore forms are readily distinguishable. The bacteriemic infection of the host is very similar in the two cases. Neither bacterium has been cultured artificially with any degree of success.

Both types of milky disease, described by S. R. Dutky (*J. agric. Res.*, 1940, 61, 57–68) and designated by him as Type A (*B. popilliae*) and Type B (*B. lentimorbus*), can be individually induced in host larvae by injection into the body cavity of adequate numbers of the respective bacterial spores. Both types of bacterial parasitism, however, do not occur in the same host individual. If a mixture of *B. popilliae* and *B. lentimorbus* spores is injected into a host larva, only Type A or Type B develops —not both. The relative spore dosage largely determines which type is successful. In most cases, Type A

develops, but if the number of *B. lentimorbus* spores injected greatly exceeds the number of *B. popilliae* spores, Type B may develop. Under certain other dosage conditions Type B will develop at the expense of Type A. Time also is a factor. If *B. lentimorbus* spores alone are injected into host larvae, and two days later *B. popilliae* spores are injected into the same larvae, growth of *B. lentimorbus* alone occurs except when larger dosages of *B. popilliae* are used. In the latter case the time advantage is overcome, and Type A milky disease will develop. If *B. popilliae* is given the time advantage, only Type A develops.

In direct competition, *B. popilliae* seems more potent than *B. lentimorbus*, but it is not necessarily more infectious upon injection. When spores of the two bacteria are separately injected into host larvae, fewer spores of *B. lentimorbus* than of *B. popilliae* may actually be required to cause a given rate of infection.

The effect of *B. popilliae* and *B. lentimorbus* on the growth of other microorganisms has not been investigated, but antibiotic activity might explain the mutually exclusive development of these two types of milky disease in Japanese beetle grubs. This is offered only as a suggestion until more is known of the physiological action of these two bacterial parasites. A more detailed account of the competition between *B. popilliae* and *B. lentimorbus* will be published at a later date.

R. L. BEARD

Connecticut Agricultural Experiment Station, New Haven

Relief Packages for Scientific Workers in Western Europe

Several of us have recently often been asked for information about the needs of our colleagues in Western Europe, about the most suitable things to send them, the best way to send these, etc. It seems, therefore, that it may be useful to broadcast the following information:

(1) There is still a serious shortage of food in all countries of Western Europe which have been occupied by the Axis. Though conditions have improved considerably since the liberation of most of these countries, the amount of calories and vitamins which our colleagues and their families receive is very often still inadequate, and, moreover, it is nearly always given in forms which are dreadfully monotonous.

(2) Scientists in North America who feel a desire to assist their colleagues in Western Europe by sending one or a few relief packages should not hesitate to do so and should do this in the near future. If one has had dealings in the past with an outstanding colleague, one should most positively not be afraid to embarrass him with a gift package. If he does not need it, which is not likely, he will turn all or part of the contents over to one of his associates who may need it more. Packages can also be sent addressed to: The Staff, ———— Laboratory, University of ————.

(3) It is advisable to use the folding boxes sold at Woolworth's and similar stores for sending packages to men in the armed forces serving overseas (size, about $8'' \times 12'' \times 15\frac{1}{2}''$). Experience has shown that these comparatively small boxes go through much quicker and stand up much better in transit than larger boxes. P boxes as tightly as possible and wrap each article kraft (better than newspaper). After the box has b filled and small openings have been closed with s useful things as matches, pins, adhesive tape, razor bla (all wrapped in kraft), it is best to close the boxes w gummed tape. The entire box should then be wrapp in strong kraft. It is well to put an address directly the box and one outside on the package. Close w twine (not tape) and tighten well. Only articles wh are dry or have been packed in well-closed tins sho be sent. Glass jars should never be sent.

Cigarettes (unless already wrapped in cellophane soap, tea, etc. should be wrapped first in wax pap and then in kraft.

(4) Though it is not possible to give ironclad rul concerning the things most needed and appreciated, is safe to assume that the following things will be pa ticularly welcome: canned meat, canned vegetable fa canned butter, canned peanut butter, sweetened coc (much better than unsweetened), tea (takes less spa than coffee), coffee (now again available in tins), so (toilet soap or Ivory, scentless), toothbrushes, too powder (less risky than tooth paste), razor blades, sha ing cream (sticks), needles, safety pins, pins, yar thread, shoe soles, shoestrings, elastic (very mu needed!), matches (wrap in kraft and use to fill sma spaces in packages), etc. Dried fruits such as raisin prunes, figs, and dates are always welcome, as well a hard candy (often safer to send than chocolate).

Cigarettes are in many cases more welcome than any thing else; they are still often used for unbelievable exchanges for goods or services. Some colleagues prefe tobacco (now again in tins) or cigars (should be ind vidually wrapped in cellophane).

Colleagues with children will appreciate milk powder, seedless raisins, and an occasional toy.

(5) Postal regulations permit the sending of on package a week to one addressee. Packages should be clearly marked: "Gift—Limited Value." Here follows a list of countries with some information concerning rates, customs forms needed, and limit of weight per package.

In the following countries the limit of weight per package is now 11 lb., the cost 14¢ per lb., and Post Office Forms 2966 and 2922 must be filled out and attached to the package: *Norway, Denmark, Finland.*

Poland. The limit is 11 lb.; 14¢ per lb.; forms needed: Nos. 2966 (two copies) and 2922.

Netherlands. The limit is 11 lb., 14¢ per lb.; forms needed: Nos. 2972 and 2922.

Netherlands Indies. Small packages cannot be sent to the Netherlands Indies, but small cases can be shipped via Messrs. Funch, Edye and Company, Inc., 25 Broadway, New York 4, New York, from whom further particulars may be obtained.

Belgium. The limit is 11 lb.; 14¢ per lb.; forms needed: 2966 (two copies), 2972, and 2922.

France. The limit is 11 lb.; 14¢ per lb.; forms needed: 2966, 2967, 2972, and 2922.

Italy and Greece. The limit is 11 lb.; 14¢ per lb.; forms needed: 2966, 2972, and 2922.
Yugoslavia. The limit is 11 lb.; $1.83 for 11 lb.; forms needed: 2966 and 2922.
Czechoslovakia. The limit is 11 lb.; $1.70 for 11 lb.; forms needed: 2966 and 2922.
England. The food situation in England (11 lb.; 14¢ lb.; forms needed: 2966 and 2922) has not been so good lately, and in some ways it is worse than it was during the war years. Rationing is said to function smoothly and honestly, but the diet is limited and dull. Conditions are not in any way as bad as they are in most countries of Western Europe, and packages should briefly be sent to colleagues with whom one has had relations for a longer time.

There are a number of firms which make up gift packages for shipping to the countries overseas. They are often in a position to send such things as butter in cans, which an individual cannot easily obtain. A reliable firm is: Fraser, Morris and Company, 119 West 57th Street, New York 19, New York, which will send a price list upon request. The Universal Tobacco Company specializes in sending cigarettes, cigars, and tobacco overseas (276 Fifth Avenue, New York 1, New York).

(6) After sending a first gift package, one may inquire if the colleague to whom it has been sent does not have any special needs. Many are in desperate need of things which are easily and cheaply available in the USA, such as slides, cover glasses, certain stains, one or two recent books, rubbers for a child, a hotwater bottle for an aged member of the family, hose, or underwear, etc. Medicines are now mostly available in sufficient quantities. Letters received from colleagues to whom gift packages have been sent should be considered as personal communications and should never be published in full without the writer's consent.

(7) The governments of most of the countries of Western Europe have been acquiring scientific periodicals and also often books published during the war years in the Americas and the United Kingdom. This literature is now being forwarded and will be distributed in due time amongst the largest libraries. All this is, of course, only a drop in the bucket. Many colleagues are in great need of literature. In most cases they can send older books in exchange or they will be able to pay for books sent, within a year or two.

Publishers and managers of scientific periodicals should be liberal in allowing their former subscribers one or two year's credit during the years of the early reconstruction period in Western Europe. When the Nazis left, the financial structure of these countries was in a deplorable state.

But not only scientific literature is needed. "Pocket books" of the better kind can easily be included in gift packages. A few numbers of *Time*, *Life*, or *Newsweek* will find many grateful readers, and a gift subscription to one of these magazines would be very welcome.

FRANS VERDOORN
Chronica Botanica, Waltham, Massachusetts

Book Reviews

Studies in biophysics: the critical temperature of serum **(56°). Lecomte du Noüy. New York: Reinhold, 1945. Pp. vi + 185. (Illustrated.) $3.50.**

The group of closely related experimental researches described in this monograph include much of the available data to justify the author's point of view that "serum is a complex, fragile liquid." His contention is that it must be examined "kinematically" in order to obtain a true picture of its biological properties. Quantitative results were attained by refining old techniques of measuring viscosity and surface energy, and creating new ones by employing optical precision methods for determining the absorption and scattering properties of serum near its inactivation temperature (56° C.).

The evidence points to profound modifications taking place in the structure of the proteins, and of the lipoprotidic complex around 56° C. Du Noüy concludes that it is through the systematic further study of the "serum molecules" possessing immunological properties, and of the globulin fraction of the serum, that rapid progress in immunological problems will be made.

The Introduction is followed by 11 chapters discussing adsorption (monomolecular layers), viscosity, rotary power and dispersion, absorption and scattering, coagulation by heat, sedimentation, electric conductivity, hydrogen ion concentration, fixation of ether by serum, interfacial tension, and ultraviolet absorption. Detailed data and graphic results are presented to show how these properties vary with changes in temperature. Variations around 56° C. are discussed in detail.

To the physicist who is teaching biophysics this is recommended as an excellent source for illustrative material. To the biologist and medical scientist it can be recommended as an example of the biophysical approach, which the basic biological research of the future must follow to attain its ideal quantitative goal.

The author's distinguished contributions in this field are in themselves a more than sufficient insurance of the value of the monograph.

OTTO STUHLMAN, JR.
University of North Carolina, Chapel Hill

Principles of radio for operators. **Ralph Atherton. New York: Macmillan, 1945. Pp. x + 344. $3.75.**

This book is the outgrowth of the author's experience in training Navy men and women as radio operators. Its 16 chapters were assigned, one chapter per week, during a 16-week course. The subject matter is well selected for this purpose. Each chapter includes descriptions of appropriate demonstrations and experiments as well as review tests and lists of available films for visual-aid instruction. The general plan of instruction is excellent.

In general, the discussion of batteries, meters, and radio apparatus is superior to that of fundamental electrical theory, motors, and generators. Weaker chapte[rs] are due, in part, to a loose and often confusing style [of] exposition. The better chapters are well written.

Chapter 5, "Motors and Generators," is particular[ly] inadequate in view of the importance of rotating machi[n]ery in radio communication. Some explanations are n[ot] clear and appear erroneous. In places, even a we[ll] informed reader is not sure what the author has [in] mind. Students, for whom the book is written, will fi[nd] portions of this chapter obscure and confusing. Wi[th] the exception of one sentence on the starting-box f[or] d-c motors no mention is made of motor and generat[or] starting and protective equipment. A-c machinery [is] passed over hastily and quite inadequately.

A 41-page appendix of miscellaneous information us[e]ful to the radio operator is included. Rules on "Safet[y] First" when handling radio transmitters and standa[rd] instructions for giving artificial respiration are com[-]mendable material. Less justified are the 30 pages de[-]voted to tables of vacuum tube characteristics and socke[t] connections. Such information, while possibly useful t[o] the radio operator in "trouble shooting," is primarily of interest to the designing engineer. The space required for these tables might have been used to better advantage for material to strengthen portions of the text.

LEONARD F. FULLER
Palo Alto, California

Electronics for engineers. **John Markus and Vin Zeluff (Eds.) New York: McGraw-Hill, 1945. Pp. x + 390. (Illustrated.) $6.00.**

This rather unusual book is a collection of 142 articles, reference sheets, charts, and graphs selected by two of the editors of *Electronics* from the files of this trade journal for the past 10 years and reprinted for the use of electronic engineers. The result is a book which is excellent in parts, which covers a wide range of topics, and which has represented a great deal of labor in computation on the part of the authors responsible for the charts and graphs. The faults of the book arise because the editors have restricted themselves to such material as has been submitted for, and accepted by, *Electronics*. This method of selection has unique merits and unique faults. It surely means that, in the opinion of both an editor and an author, the material presented has timely engineering interest. However, the use of such a method insures neither completeness nor uniformity of treatment on any given topic. The quality and worth of any given section of the book is determined largely by the care and judgment used by the authors of the papers making up the section.

The range of subjects treated is wide. The greater portion of the book is devoted to circuit elements, transmission lines, and electric networks intended for specific applications, with correspondingly less emphasis on

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vacuum tubes and physical electronics. Thus, there are sections on components such as capacitors, iron-core transformers, permanent magnets, relays, and r-f coils and transformers. In the field of circuit design, there are papers on audio circuits, filters, wide-band amplifiers, and television circuits. Miscellaneous topics treated include pulses, antennas, electronic heating, and industrial control. There are no papers on magnetrons, klystrons, cavity resonators, or wave propagation.

The fact that a topic is of sufficient importance to warrant inclusion in the book by no means indicates that it will receive a well-balanced treatment. Thus, 14 papers deal with transmission lines, including one which describes the extremely useful Smith chart for making line calculations. Lines are treated adequately from an engineering-design point of view. In similar fashion, the treatment of electronic heating is well rounded. By contrast, the broad field of oscillators is dismissed with two papers, both fair: one on phase shift oscillators, and the second on the temperature coefficient of quartz. Few engineers would consider the treatment accorded oscillators at all adequate.

The greatest value of this book arises from the fact that it furnishes to the engineer a wide variety of information in a form convenient for reference. The book is to be recommended in particular to those engineers who enjoy using charts and graphs in making their own calculations.

W. D. HERSHBERGER
RCA Laboratories, Princeton, New Jersey

Human biochemistry. Israel S. Kleiner. St. Louis: C. V. Mosby, 1945. Pp. 573. (Illustrated.) $6.00.

There has long been need for a textbook on biochemistry which presented all the essential facts regarding the subject from the viewpoint of its usefulness in the practice of medicine. The author states in his Preface: "It is not so many years since physiological chemistry was essentially a pure science course in medical schools and reference to clinical applications was incidental if not accidental. . . . The name biochemistry has come half way from the laboratory to the clinic. The student now is shown the subject as an integral part of the practice of medicine—not just as a part of the medical curriculum. He learns that advances in every branch of medicine, surgery, and dentistry, have been made as a result of biochemical research, that the human body *is* applied biochemistry, that the entire field of physiology is a series of biochemical reactions and pathological phenomena result from disturbances of these same reactions, and that biochemical discoveries are more and more responsible for progress in diagnosis and therapeutics. The present volume is an attempt to bring home to the student these clinical aspects of biochemistry wi usurping any clinician's domain and without negle the fundamentals." The author would appear to been very successful in his efforts to attain these o tives, and the book should hold the interest of students who look forward to the practice of medi and also stimulate those who vision a scientific caree medicine.

It could not be expected that in this relatively book it would be possible to cover fully all the esse facts of biochemistry and to discuss their most impor clinical applications as well. However, the author used excellent judgment in the fundamental bioch istry he has included, although in some cases the bre may suggest a lack of importance that is not inten Most departments of biochemistry employ their laboratory directions. In accord with this the au touches on the principles of only a few of the most damental methods. This materially aids in concise direct presentation of the subject.

Active fields of biochemical research such as enzy vitamins, and hormones are excellently presented, w the discussion on carbohydrate, lipid, protein, and eral metabolism and water and acid-base balance wo appear commensurate with the scope of the book. P tical clinical applications of biochemical facts and me ods will be noted on nearly every page of the book, such topics as diet therapy, basal metabolism, chan in the chemical composition of the blood, and rec clinical applications of biochemical methods are given fuller discussion than is found in most other texts biochemistry. Presentation of biochemistry from t point of view cannot help but instill in the minds medical and dental students the usefulness as well the practical importance of the subject.

In the classification of proteins, in the chapter proteins, the author omits the third group, "Deriv Proteins," given in the usual classification, for t reason that this group includes either denatured protea or mixtures of protein decomposition products. Althou this is true, most biochemists will probably still fe that we need a heading to cover this group of sub stances. Like many other first editions, the book co tains a number of typographical and other minor error These will probably soon be corrected and other mino changes made to strengthen the original plan of the text

The book can be recommended to teachers of biochem istry, especially those who believe that in the presenta tion of the subject stress should be given to practica applications as well as to fundamental principles.

VICTOR C. MYER
School of Medicine
Western Reserve University, Cleveland